Maj. Miller

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FLIGHT MANUAL

USAF SERIES

T-39A

AIRCRAFT

CONTRACT

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CURRENT FLIGHT CREW CHECKLIST

T.O. 1T-39A-1CL-1 DATED 30 SEP 1966, CHANGED 31 JUL 1967

Upon receipt of the second and subsequent changes to this manual, librarians shall ascertain that all previous changes have been received and incorporated. Prompt action should be taken if the manual is incomplete.

* The asterisk indicates pages changed, added, or deleted by the current change.

ADDITIONAL COPIES OF THIS PUBLICATION MAY BE OBTAINED AS FOLLOWS:

USAF ACTIVITIES.—In accordance with Technical Order No. 00-5-2.

G-3 USAF

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T39A-1-00-2A

Scope.

This manual contains the necessary information for safe and efficient operation of the T-39A. These instructions provide you with a general knowledge of the airplanes, their characteristics, and specific normal and emergency operating procedures. Your flying experience is recognized, and therefore, basic flight principles are avoided.

Sound Judgment.

This manual provides the best possible operating instructions under most circumstances, but it is not a substitute for sound judgment. Multiple emergencies, adverse weather, terrain, etc, may require modification of the procedures.

Permissible Operations.

The Flight Manual takes a "positive approach" and normally states only what you can do. Unusual operations or configurations (such as asymmetrical loading) are prohibited unless specifically covered herein. Clearance must be obtained from the Flight Manual Manager before any questionable operation is attempted which is not specifically permitted in this manual.

How to Be Assured of Having Latest Data.

Refer to T.O. 0-1-1-5A, which lists all current Flight Manuals, Safety Supplements, Operational Supplements, and Checklists. Its frequency of issue and brevity ensures an accurate, up-to-date listing of these publications.

Standardization and Arrangement.

Standardization assures that the scope and arrangement of all Flight Manuals are identical. The manual is divided into 10 fairly independent sections to simplify reading it straight through or using it as a reference manual. The first three sections must be read thoroughly and fully understood before attempting to fly the airplane. The remaining sections provide important information for safe and efficient mission accomplishment.

Supplements.

The current status of each Supplement affecting your airplane can be determined by referring to T.O. 0-1-1-5A. The title page of the Flight Manual and the title block of each Supplement should be checked to determine the effect they may have on existing Supplements. You must remain constantly aware of all Supplements - current Supplements must be complied with but there is no point in restricting your operation by complying with a replaced or rescinded Supplement. Upon receiving each Supplement, file it in the front of your Flight Manual, and make reference to it on the Supplement Summary page. If existing Flight Manual information or procedures are revised, a reference to the applicable Supplement should then be written in the margin of the page opposite the affected write-up. A Safety Supplement may be replaced by an Operational Supplement or an Operational Supplement may be replaced by a Safety Supplement.

SAFETY SUPPLEMENTS. Information involving safety will be promptly forwarded to you by Safety Supplements. Supplements covering loss of life will get to you in 48 hours by TWX, and those concerning serious damage to equipment within 10 days by mail.

OPERATIONAL SUPPLEMENTS. Nonsafety requirements or airplane changes affecting flight crew information that is not timely, or that cannot be practically or adequately covered in the Flight Manual at the time of a scheduled change or revision will be forwarded to you by Operational Supplements.

Checklists.

The Flight Manual contains only amplified checklists. Abbreviated checklists have been issued as separate technical orders. (Refer to the back of the title page for the T.O. number and date of your latest checklist.) Line items in the Flight Manual and checklists are identical with respect to arrangement and item number. Whenever a Supplement affects the abbreviated checklist, write in the applicable change on the affected checklist page. As soon as possible, a new checklist page, incorporating the supplement will be issued. This will keep nandwritten entries of Supplement information in your checklist to a minimum.

How to Get Personal Copies.

Each flight crew member is entitled to personal copies of the Flight Manual, Safety Supplements, Operational Supplements, and Checklists. The required quantities should be ordered before you need them to assure their prompt receipt. Check with your supply personnel; it is their job to fulfill your Technical Order requests. Basically, you must order the required quantities on the Numerical Index and Requirement Table (T.O. 0-1-1-5). Technical Orders 00-5-1 and 00-5-2 give detailed information for properly ordering these publications. Make sure a system is established at your base to deliver these publications to the flight crews immediately upon receipt.

Flight Manual and Checklist Binders.

Loose-leaf binders and sectionalized tabs are available for use with your manual. These are obtained through local purchase procedures and are listed in the Federal Supply Schedule (FSC Group 75, Office Supplies, Part 1). Binders are also available for carrying your abbreviated checklist. These binders contain plastic envelopes into which individual checklist pages are inserted. They are available in three capacities: 15-, 25-, and 40-envelope binders. Check with your supply personnel for assistance in securing these items.

J201 Computer.

A J201 computer (Federal Stock No. 6686-076-0759) is included as miscellaneous equipment with this airplane. This computer is used to compute P_{t5} for engine thrust setting and as an aid to in-flight planning. It is also a valuable aid in obtaining various conversion and correction factors, as well as performing certain numerical computations. Operation of this computer is explained in Appendix I of this manual. The J201 computer is stowed in a pouch on the overhead panel. Additional computers may be obtained through normal supply channels.

Warnings, Cautions, and Notes.

The following definitions apply to "Warnings," "Cautions," and "Notes" found throughout the manual.

Warning Operating procedures, techniques, etc, which will result in personal injury or loss of life if not carefully followed.

Caution Operating procedures, techniques, etc, which will result in damage to equipment if not carefully followed.

NOTE An operating procedure, technique, etc, which is considered essential to emphasize.

Illustration Changes.

To help you more easily find, on illustrations, changes that might otherwise be inconspicuous, the following identifier will be used: NEW

Your Responsibility - To Let Us Know.

Every effort is made to keep the Flight Manual current. Review conferences with operating personnel and a constant review of accident and flight test reports assure inclusion of the latest data in the manual. However, we cannot correct an error unless we know of its existence. In this regard, it is essential that you do your part. Comments, corrections, and questions regarding this manual or any phase of the Flight Manual program are welcomed. AF Form 847 will be used for recommending changes to the Flight Manual in accordance with instructions in AFR 60-9 and T.O. 00-5-1. These will be forwarded through command headquarters to SMAMA, McClellan AFB, California 95652, Attn: SMNSTT. AF Forms 847 are routed to SMNSTT for control purposes only. Technical content of the Flight Manual is the responsibility of the Flight Manual Manager (SMNEOH), and all comments and questions transmitted by means other than the AF Form 847 will be submitted directly to the Flight Manual Manager, SMAMA, McClellan AFB, California 95652, Attn: SMNEOH.

System Limits and Tolerances.

In some cases, the limits and tolerances presented in the Flight Manual are not precisely identical to those presented in the Systems Maintenance Manuals. The numerical values in the Flight Manual are to be used as operating guides by flight personnel.

SUPPLEMENT SUMMARY

Safety Supplements are numbered as follows: 1SS-1, 1SS-2, etc. Operational Supplements are numbered 1S-1, 1S-2, etc. The supplements you receive should follow in sequence, and if you find you are missing one, check T.O. 0-1-1-5A to see whether the supplement was issued and, if so, is still in effect. It may have been replaced or rescinded before you received your copy. If it is still active, see your Publication Distribution Officer and get your copy. It should be noted that a supplement number will never be used more than once.

SUPPLEMENTS REPLACED BY THIS CHANGE OR RESCINDED

NUMBER	DATE	SHORT TITLE	DISPOSITION
1S-12	28 JUL 1967	INCREASED SEATING CAPABILITY	SECTION I, IV, V, AND APPENDIX I
1S-16	2 JUN 1967	TAKEOFF AND LANDING CROSSWIND CHART	REPLACED BY 1S-17
1SS-49 (INT)	27 JUN 1967	FLIGHT RESTRICTIONS DUE TO RAPID DECOMPRESSION (ENTRANCE DOOR FAILURE)	REPLACED BY 1SS-50
1SS-50 (INT)	28 JUN 1967	FLIGHT RESTRICTIONS DUE TO RAPID DECOMPRESSION (ENTRANCE DOOR FAILURE)	REPLACED BY 1SS-51
1SS-51 (INT)	30 JUN 1967	FLIGHT RESTRICTIONS DUE TO RAPID DECOMPRESSION (ENTRANCE DOOR FAILURE)	REPLACED BY 1SS-52

ACTIVE SUPPLEMENTS

This portion is to be filled in by you when you receive your Flight Manual and to be added to as you receive additional supplements. Refer to T.O. 0-1-1-5A for latest information if any questions arise. Supplements outstanding at the time of preparation of this page have been listed below for your convenience.

NUMBER	DATE	SHORT TITLE
1S-11	26 JAN 1967	ENGINE OPERATION IN THE 79% – 81% RANGE
1S-13	10 MAY 1967	CROSS-FEED VALVE
1S-14	31 MAR 1967	SPEED BRAKE INFORMATION OPERATING PROCEDURE
1S-15	24 MAY 1967	BEFORE STARTING ENGINE
1S-17	1 AUG 1967	TAKEOFF AND LANDING CROSSWIND CHART
1S-18	4 AUG 1967	EMERGENCY ESCAPE HATCH
1SS-48	19 APR 1967	REVISED BAIL-OUT PROCEDURE
1SS-52	21 JUL 1967	FLIGHT RESTRICTIONS DUE TO RAPID DECOMPRESSION (ENTRANCE DOOR FAILURE).

NOTE

As of the title page date, the following Safety Supplements have not been issued:

SS-1-36
SS-1-40
SS-1-41

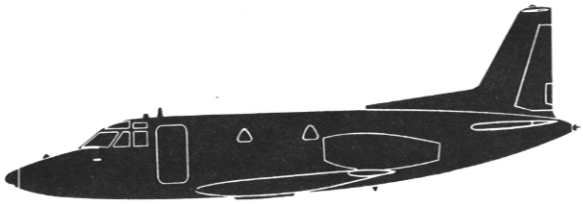
39A-1-00-45M

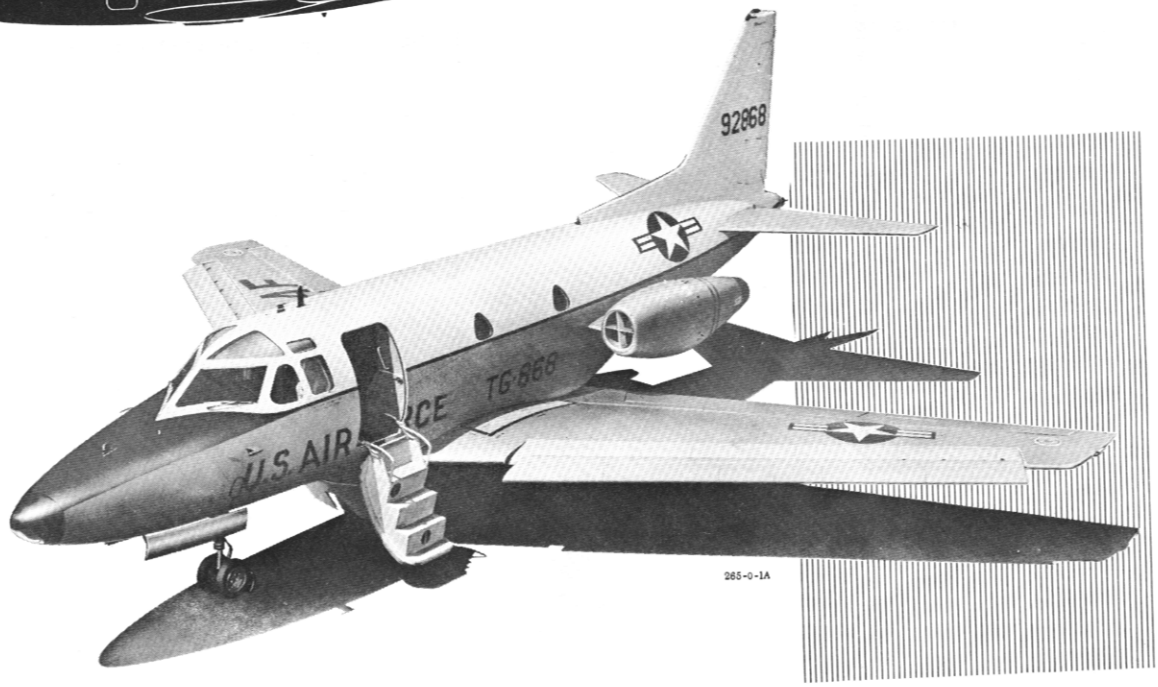
T.C.T.O. IDENTIFICATION

The following T.C.T.O.'s affecting T-39A Airplanes are covered in this manual. This is not a complete listing and only includes T.C.T.O.'s listed by number in this manual. Refer to the Numerical Index and Requirement Table (T.O. 0-1-1-5) for the complete listing of T.C.T.O.'s for these airplanes.

T.O. NUMBER	SUBJECT
1T-39A-534 or -544	Installation of VHF-101 and AN/ARN-59 ADF equipment
1T-39A-547	Installation of VHF radio
1T-39A-548	Installation of hydraulic pressure gage and pressure release valve
1T-39A-549	Increased seating capability - T-39A Airplanes
1T-39A-552	Installation of secure speech capability - T-39A Airplanes
1T-39-758	Installation of foot warmers in cockpit and cabin - T-39 Series Airplanes
1T-39-760	Modification of main landing gear door for ground clearance - T-39 Series Airplanes
1T-39-767	Removal of ice detector system - T-39A and T-39B Airplanes
1T-39-770	Replacement of landing gear control switch- T-39 Series Airplanes
1T-39-771	Modification of nose wheel steering system
1T-39-774	Removal of generator overheat thermostatic switch

T-39A





T-39A-1-00-3C

DESCRIPTION

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AIRPLANE.

The T-39A Airplane, built by North American Aviation, Inc, is a low-wing, twin-jet monoplane with an axial-flow engine pod-mounted on each side of the aft fuselage. The airplane is a utility trainer, with a crew of two and a passenger capacity of four or, on some airplanes† a passenger capacity of seven. The primary mission of this airplane is flight training and maintenance of flying proficiency on multiengine jet airplanes. This can be accomplished in conjunction with use of the airplane as a high-speed utility airplane on administrative support missions. The cockpit and cabin compartments are pressurized and soundproofed for comfortable high-altitude flight. The airplane is provided with a plug-type entrance door, on the left side of the fuselage forward of the wing, which rotates down, forming steps for entry. An in-flight escape hatch is in the underside of the fuselage, and a ground escape hatch is on the right side of the fuselage. The 28-degree swept-back wing has aerodynamically operated slats on the leading edge and electrically operated flaps on the inboard trailing edge.

The fuel supply is carried in the integral wing tanks and fuselage tank. Fuel servicing is performed through a single-point pressure refueling receptacle on the inboard lower surface of the right wing leading edge. Three gravity-flow fuel filler receptacles are provided, one on the upper surface of each wing panel at the tip and one on the aft fuselage right side upper surface. An electrically actuated, hydraulically operated speed brake, which can be used at any airspeed, is on the lower surface of the fuselage.

AIRPLANE DIMENSIONS.

The over-all dimensions of the airplane (airplane on landing gear at normal weight, with specified tire and gear strut inflation) are as follows:

Span	44 feet 6 inches
Length	44 feet
Height (to top of fin)	16 feet

For the minimum turning radius and ground clearance, see figure 2-4.

AIRPLANE WEIGHTS.

Some Airplanes.†

The approximate take-off gross weight is as follows:

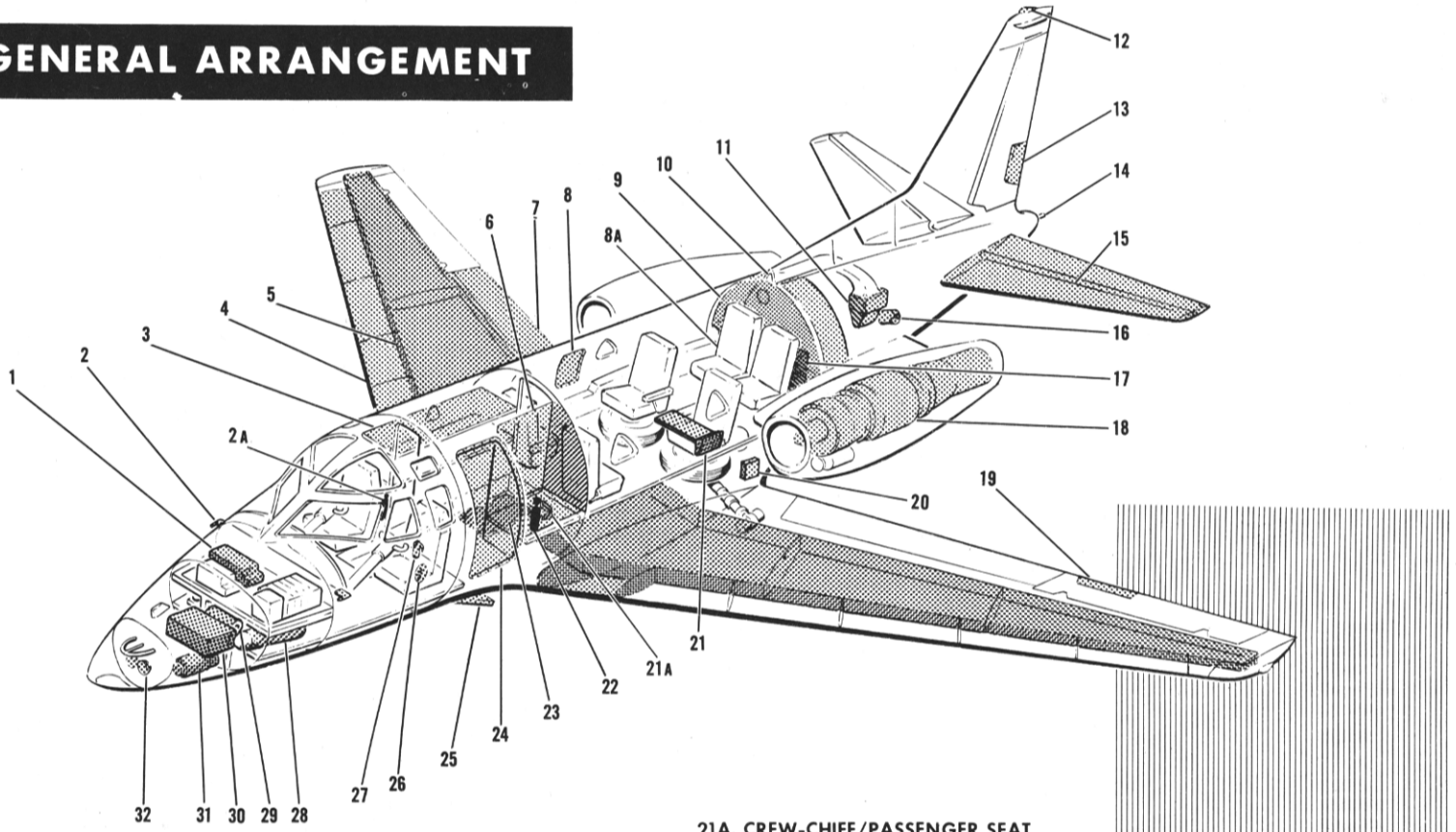
Crew of two, four passengers, baggage, and wing fuel	16,700 pounds
The preceding, plus fuselage fuel	17,760 pounds

The approximate basic weight is as follows:

Airplane plus engine oil and trapped fuel	9250 pounds

† Airplanes changed by T.O. 1T-39A-549
† Airplanes not changed by T.O. 1T-39A-549

GENERAL ARRANGEMENT



1. RADIO EQUIPMENT
2. PITOT HEAD (TYPICAL BOTH SIDES)
2A. WALK-AROUND OXYGEN BOTTLE †
3. BAGGAGE COMPARTMENT
4. WING SLATS
5. INTEGRAL WING FUEL TANKS
6. COAT COMPARTMENT †
7. WING FLAPS
8. GROUND ESCAPE HATCH
8A. TWO-PASSENGER/BAGGAGE SEAT †
9. FUSELAGE FUEL CELL
10. RAM-AIR INLET
11. HEAT EXCHANGER
12. ANTICOLLISION LIGHT
13. RUDDER TRIM TAB
14. FUEL JETTISON AND VENT
15. TRIMMABLE HORIZONTAL STABILIZER
16. HYDRAULIC RESERVOIR
17. BATTERIES (TWO)
18. J60 TURBOJET ENGINE (TYPICAL BOTH SIDES)
19. AILERON TRIM TAB
20. DC EXTERNAL POWER RECEPTACLES
21. NAVIGATOR'S TABLE AND INSTRUMENTS†
21A. CREW-CHIEF/PASSENGER SEAT WITH CHEMICAL TOILET †
22. WALK-AROUND OXYGEN BOTTLE †
23. IN-FLIGHT ESCAPE HATCH
24. ENTRANCE DOOR
25. SPEED BRAKE
26. WING ICE CHECK LIGHT (TYPICAL BOTH SIDES)
27. HAND FIRE EXTINGUISHER
28. OXYGEN CYLINDER
29. STAND-BY INVERTER
30. TACAN EQUIPMENT
31. MAIN INVERTER
32. LANDING AND TAXI LIGHTS

†Some airplanes. (Refer to applicable text.)

Figure 1-1

Some Airplanes. †

The approximate take-off gross weight is as follows:

Crew of two, seven passengers, baggage, and wing fuel . . . . . 17,377 pounds
The preceding, plus fuselage fuel . . 18,424 pounds

The approximate basic weight is as follows:

Airplane plus engine oil and trapped fuel . . . . . 9,600 pounds

For more detailed weight information, refer to "Weight Limitations" in Section V.

AIRPLANE SERIAL NUMBERS.

Airplane serial numbers are as follows:

T-39A-1 AF59-2868 through -2872
T-39A-1 AF60-3478 through -3508
T-39A-1 AF61-634 through -685
T-39A-1 AF62-4448 through -4502

INTERIOR ARRANGEMENT.

The airplane is designed to have a seating capacity for four passengers in the cabin compartment. This section also contains the entrance door, baggage compartment, coat compartment, and emergency escape provisions. Some airplanes† have a seating capacity for seven passengers. On these airplanes, a two-passenger/baggage seat is installed in the aft end of the cabin and a center-facing crew-chief/passenger seat is installed in the space previously used as a coat compartment. In addition, a chemical lavatory with an interconnecting relief tube is installed in the area underneath the crew-chief/passenger seat, and coat-hanger hooks are installed in the baggage compartment. On some airplanes,† a navigator's station is provided on the left side of the cabin compartment, with provisions for celestial, dead-reckoning, and radio navigation.

Flight Crew.

Accommodations are provided for a crew of two: Pilot and copilot, seated in the conventional side-by-side arrangement.

ENGINES.

Power is supplied by two Pratt & Whitney J60 gas turbine engines. (See figure 1-7.) The rated sea-level static thrust of each engine is 3000 pounds at Military Thrust. (Refer to Section V in this manual for operating limitations.) The engines are shock-mounted in separate pods attached to the aft fuselage section by pylons. The engine has a single-rotor, nine-stage, axial-flow compressor driven by a two-stage reaction turbine. The combustion chamber contains eight burner cans into which fuel is sprayed through single, dual-orifice nozzles mounted at the inlet of each can. High-energy ignition units and spark igniters are used to start combustion. A hydromechanical fuel control schedules the fuel flow to provide the thrust called for by the throttle setting in the cockpit, with automatic compensation for conditions at the compressor air inlet and compressor discharge. An air-bleed valve opens automatically to bleed interstage compressor air overboard to facilitate engine starting and operation at low thrust. On some airplanes,§ an ice detection and anti-ice system protects the engine guide vanes from ice formation. The exhaust total discharge pressure is measured by four probes immediately downstream of the turbine. The probes are at four unequally spaced distances around the circumference of the turbine exhaust case and are manifolded together to produce an average sampling pressure. The engine power take-off gearbox is waist-mounted and is driven by the compressor rotor through a bevel gear and shaft system which also serves as the input system during starting.

ENGINE FUEL SYSTEM.

Fuel flow to the engine is mechanically controlled by throttle movement and is delivered and regulated by the engine fuel system. This system includes the engine-driven fuel pump unit, fuel heater, fuel bypass valve, hydromechanical fuel control unit, fuel oil-cooler, and pressurization and dump valve. The engine fuel system is shown schematically in figure 1-8.

Engine Fuel Control Unit.

An engine-driven hydromechanical fuel control unit (figure 1-8) regulates fuel flow to the engine. During operation, the fuel flow is determined by a variable orifice main metering valve in the control that is governed by control signals from a mechanical computer. The metering system meters the fuel flow to be sent to the engine burners, in accordance with the amount of thrust required. The computing system monitors four operating parameters: compressor inlet pressure, engine rpm, throttle position, and compressor discharge pressure. The computing system then adjusts the metering system accordingly, thus providing for optimum engine performance.

Fuel Pump Unit.

The engine-driven fuel pump unit (figure 1-8) supplies the high fuel pressure required by the engine. The unit has a centrifugal element, a filter, a filter bypass valve, and a gear element. The centrifugal element provides an interstage fuel pressure and also has suction feed capabilities in case

† Airplanes changed by T. O. 1T-39A-549
† AF60-3478 and all later airplanes
§ Airplanes not changed by T. O. 1T-39-767

COCKPIT—FORWARD VIEW (TYPICAL)

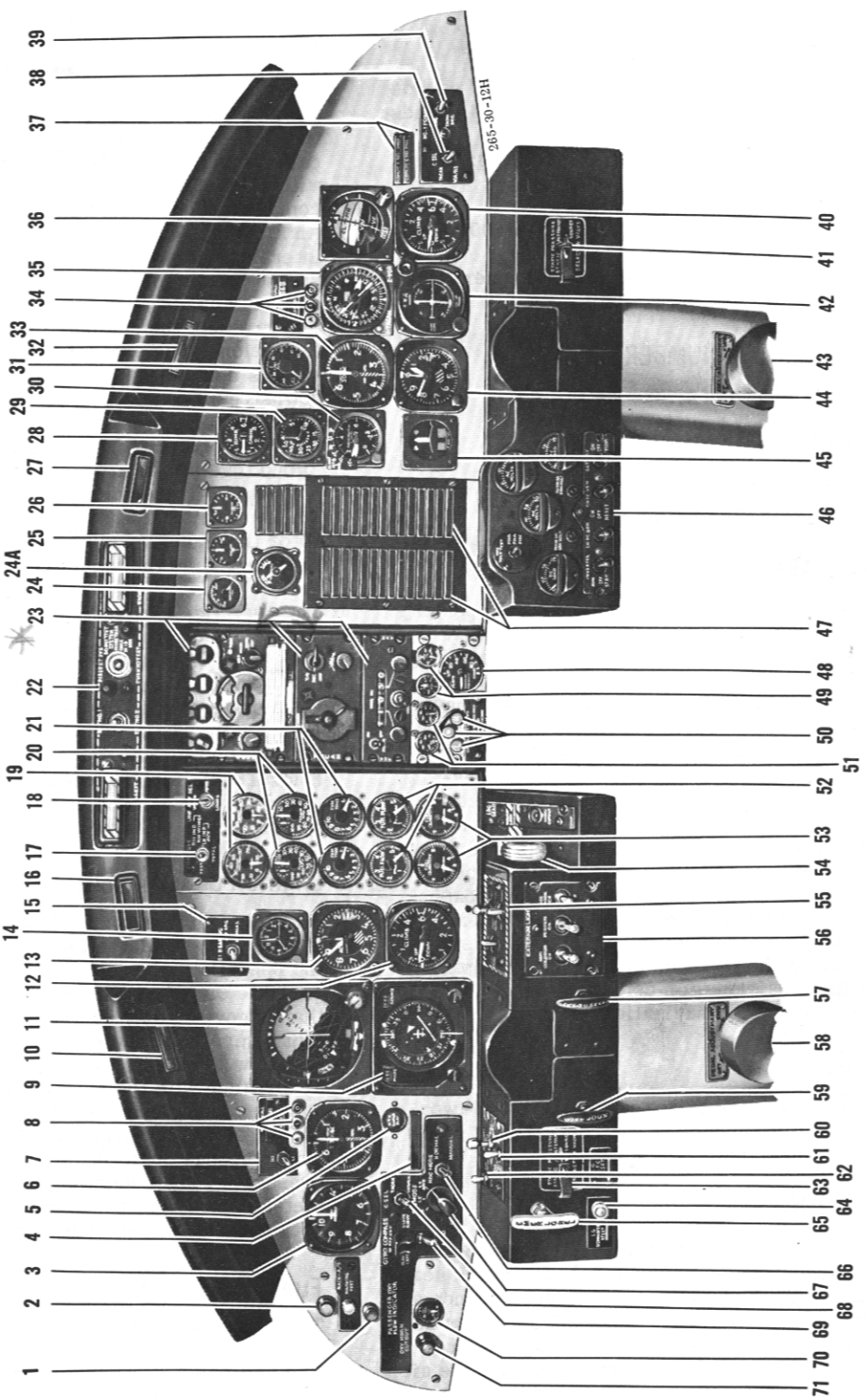


Figure 1-2

1. Passengers' oxygen flow indicator light
2. Mach-airspeed warning test button
3. Mach indicator
4. Course select fail light
5. Compass slaving indicator
6. Airspeed indicator
7. Marker beacon sensitivity switch
8. Marker beacon lights
9. Horizontal situation indicator
10. Nose wheel steering-on indicator light
11. Attitude director indicator
12. Vertical velocity indicator
13. Altimeter
14. Clock
15. HSI bearing selector switch†
16. Master caution light
17. Fuel quantity switch
18. Antenna selector switch
19. Exhaust total pressure gages
20. Tachometers
21. Exhaust gas temperature gages
22. Fire emergency control panel
23. Radio control panels
24. Horizontal stabilizer trim position indicator
24A. Engine syncronization indicator †
25. Rudder trim tab position indicator
26. Aileron trim tab position indicator
27. Master caution light
28. Cabin pressure rate-of-change indicator
29. Cabin altimeter and differential-pressure indicator
30. Accelerometer
31. Free air temperature indicator
32. Nose wheel steering-on indicator light
33. Airspeed indicator
34. Marker beacon lights
35. Bearing-distance-heading indicator
36. Attitude indicator

† Some airplanes. (Refer to applicable text.)

37. Course select inoperative and fail lights
38. Copilot's course selector switch
39. No. 1 pointer selector switch†
40. Vertical velocity indicator
41. Copilot's static-pressure selector
42. Course indicator
43. Copilot's rudder pedal adjustment knob
44. Altimeter
45. Turn-and-slip indicator
46. Electrical indicator and control panel
47. Caution-warning light panel
48. Wing flap position indicator
49. Hydraulic pressure gages
50. Landing gear position lights
51. Oil pressure gages
52. Fuel flow indicators
53. Fuel quantity gages
54. Landing gear control panel
55. Alternate trim control panel
56. Exterior lighting control panel
57. Parking brake "T" handle
58. Pilot's rudder pedal adjustment knob
59. Gust lock "T" handle
60. Speed brake emergency dump switch
61. Horizontal stabilizer trim limit test switch
62. Signal data recorder switch†
63. Pilot's static-pressure selector
64. Landing gear electric reset button
65. Landing gear emergency release "T" handle
66. Heading mode selector switch
67. Flight director mode switch
68. Pilot's course selector switch
69. Gyrocompass mode switch
70. Oxygen cylinder pressure gage
71. Oxygen warning horn cutout button

39A-1-00-17K

of airplane boost pump failure. A differential-pressure switch is installed across the centrifugal element to sense fuel pressure on each side of the pump. When the pressure differential across the pump decreases to 6 (±1) psi, the respective low fuel pressure caution light comes on. A filter is between the centrifugal boost stage and the gear stage to ensure protection of engine fuel components.

Fuel Filter Blocked Caution Light.

A "FUEL FILTER BLOCK" amber caution light (figure 1-26) is on the caution-warning light panel. This light may be energized from one of two differential-pressure switches, one on each engine. These pressure switches sense fuel pressure drop across the fuel filters. In case either the left or the right engine fuel filter becomes contaminated with ice or foreign matter and the pressure differential across the filter exceeds 7 to 8 psi, the differential-pressure switch closes and the caution light will come on. The differential-pressure switch opens when the pressure drop decreases to 6-7 psi, and the caution light will go out. In case the fuel pressure differential exceeds 9 to 11 psi, the filter bypass valve automatically opens, allowing full fuel flow to the engine. However, the caution light will remain on until normal fuel flow

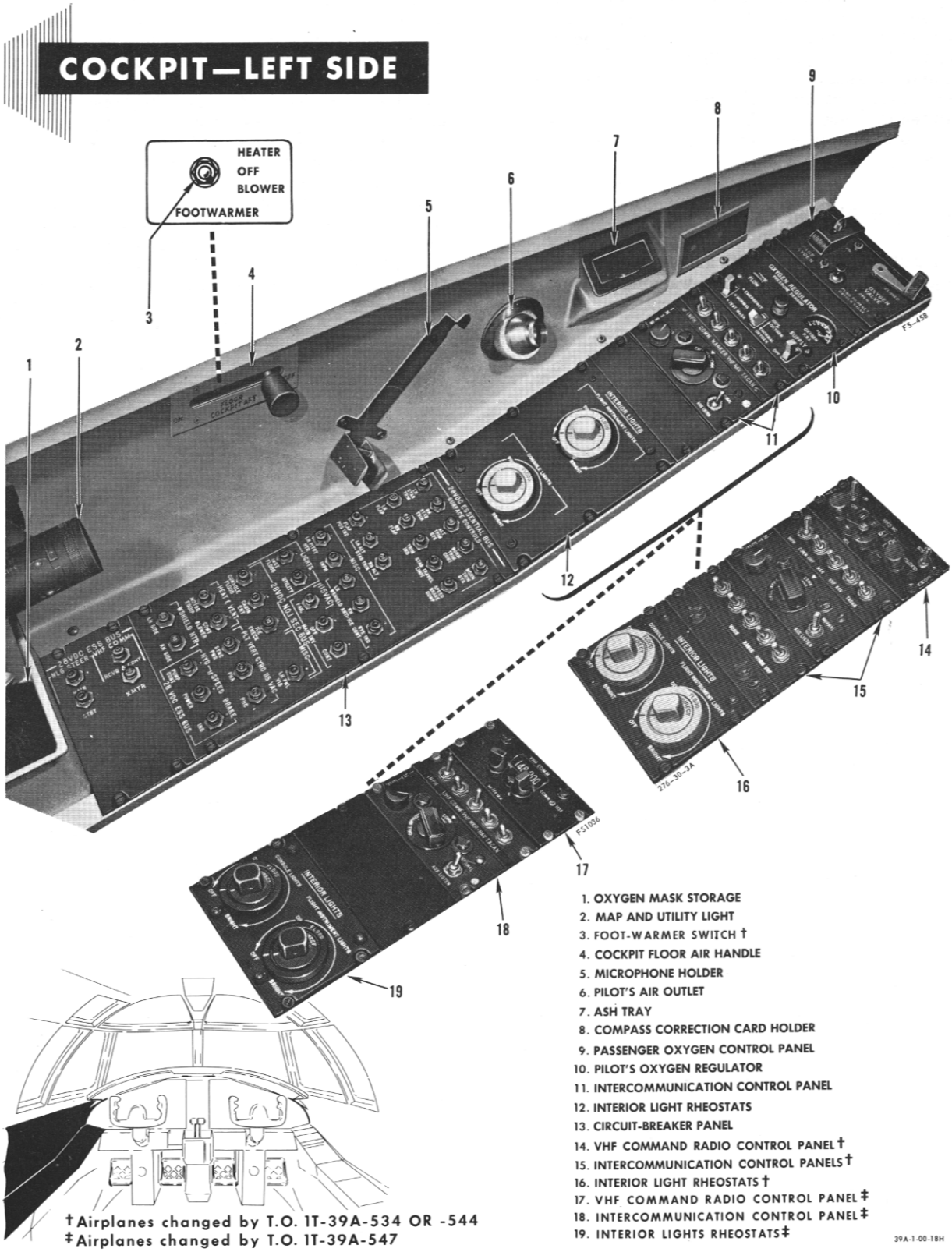
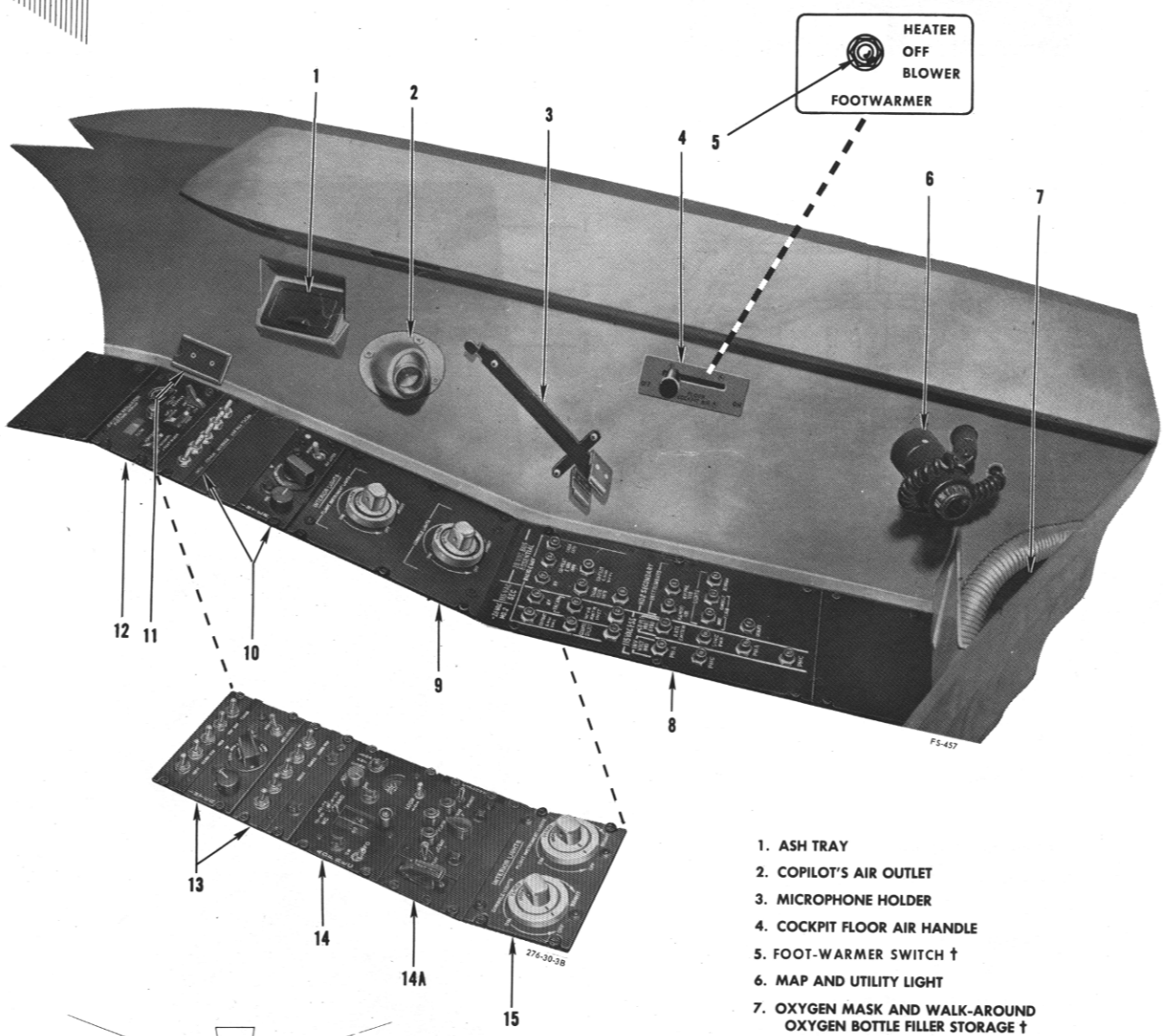
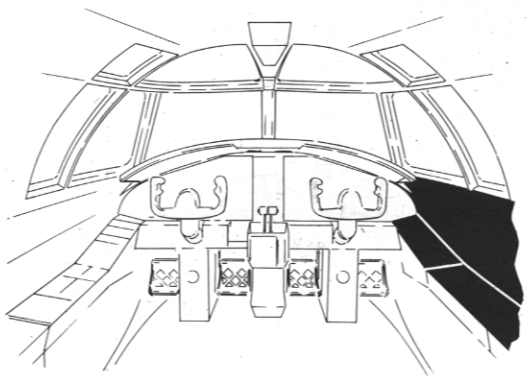

COCKPIT—LEFT SIDE
HEATER
OFF
BLOWER
FOOTWARMER
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
FS-458
FS1836
276-30-3A
1. OXYGEN MASK STORAGE
2. MAP AND UTILITY LIGHT
3. FOOT-WARMER SWITCH †
4. COCKPIT FLOOR AIR HANDLE
5. MICROPHONE HOLDER
6. PILOT'S AIR OUTLET
7. ASH TRAY
8. COMPASS CORRECTION CARD HOLDER
9. PASSENGER OXYGEN CONTROL PANEL
10. PILOT'S OXYGEN REGULATOR
11. INTERCOMMUNICATION CONTROL PANEL
12. INTERIOR LIGHT RHEOSTATS
13. CIRCUIT-BREAKER PANEL
14. VHF COMMAND RADIO CONTROL PANEL †
15. INTERCOMMUNICATION CONTROL PANELS †
16. INTERIOR LIGHT RHEOSTATS †
17. VHF COMMAND RADIO CONTROL PANEL ‡
18. INTERCOMMUNICATION CONTROL PANEL ‡
19. INTERIOR LIGHTS RHEOSTATS ‡
†Airplanes changed by T.O. 1T-39A-534 OR -544
‡Airplanes changed by T.O. 1T-39A-547
39A-1-00-18H

Figure 1-3

COCKPIT—RIGHT SIDE





1. ASH TRAY
2. COPILOT'S AIR OUTLET
3. MICROPHONE HOLDER
4. COCKPIT FLOOR AIR HANDLE
5. FOOT-WARMER SWITCH †
6. MAP AND UTILITY LIGHT
7. OXYGEN MASK AND WALK-AROUND OXYGEN BOTTLE FILLER STORAGE †
8. CIRCUIT-BREAKER PANEL
9. INTERIOR LIGHT RHEOSTATS
10. INTERCOMMUNICATION CONTROL PANEL
11. COMPASS CORRECTION CARD HOLDER
12. COPILOT'S OXYGEN REGULATOR
13. INTERCOMMUNICATION CONTROL PANELS †
14. ADF CONTROL PANEL †

NEW 14A. SECURE SPEECH CONTROL PANEL †

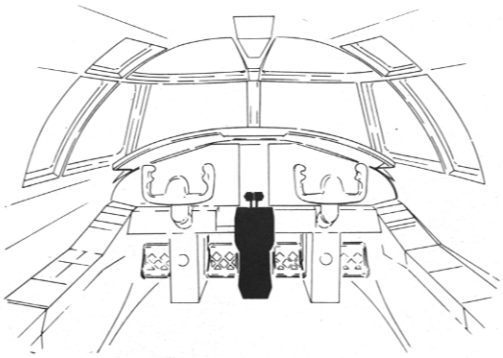
15. INTERIOR LIGHT RHEOSTATS †

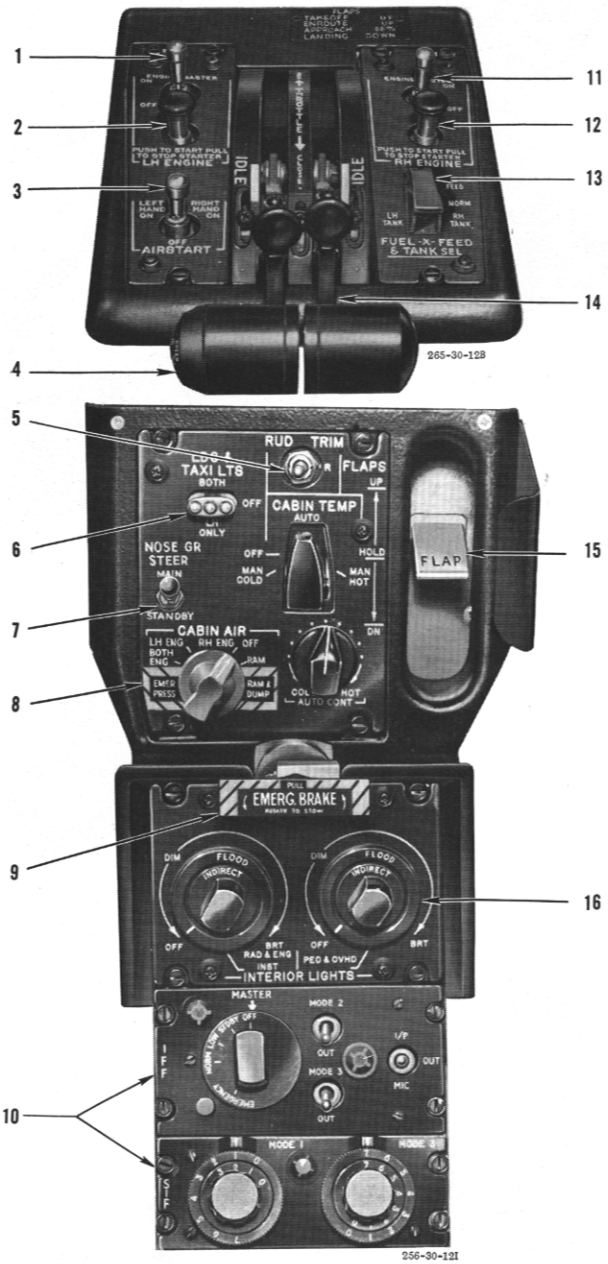
† Some airplanes. (Refer to applicable text.)

39A-1-00-19M

Figure 1-4

CENTER PEDESTAL



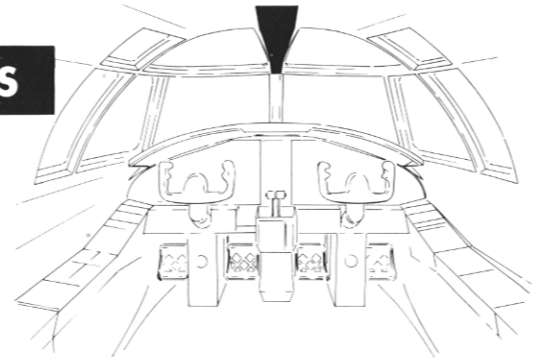


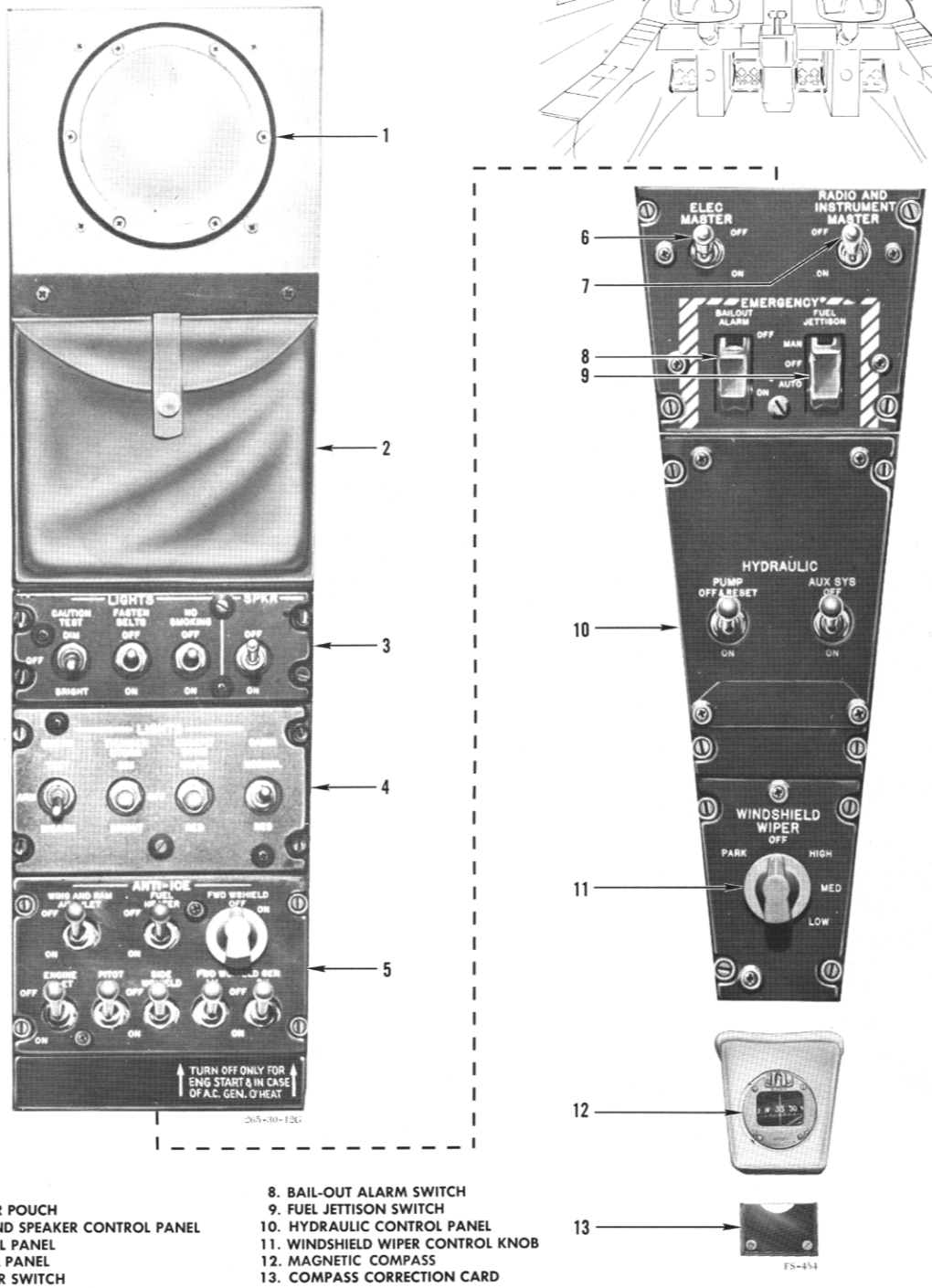
1. LEFT ENGINE MASTER SWITCH
2. LEFT ENGINE STARTER BUTTON
3. AIR START SWITCH
4. SPEED BRAKE SWITCH
5. RUDDER TRIM SWITCH
6. LANDING AND TAXI LIGHT SWITCH
7. NOSE WHEEL STEERING SELECTOR SWITCH
8. AIR CONDITIONING SYSTEM CONTROL PANEL
9. EMERGENCY BRAKE CONTROL "T" HANDLE
10. AN/APX-46V (IFF-SIF) CONTROL PANEL
11. RIGHT ENGINE MASTER SWITCH
12. RIGHT ENGINE STARTER BUTTON
13. FUEL CROSS-FEED AND TANK SELECTOR SWITCH
14. THROTTLES
15. WING FLAP HANDLE
16. INTERIOR LIGHT RHEOSTATS

T-39A-1-00-20C

Figure 1-5

OVERHEAD CONTROL PANELS



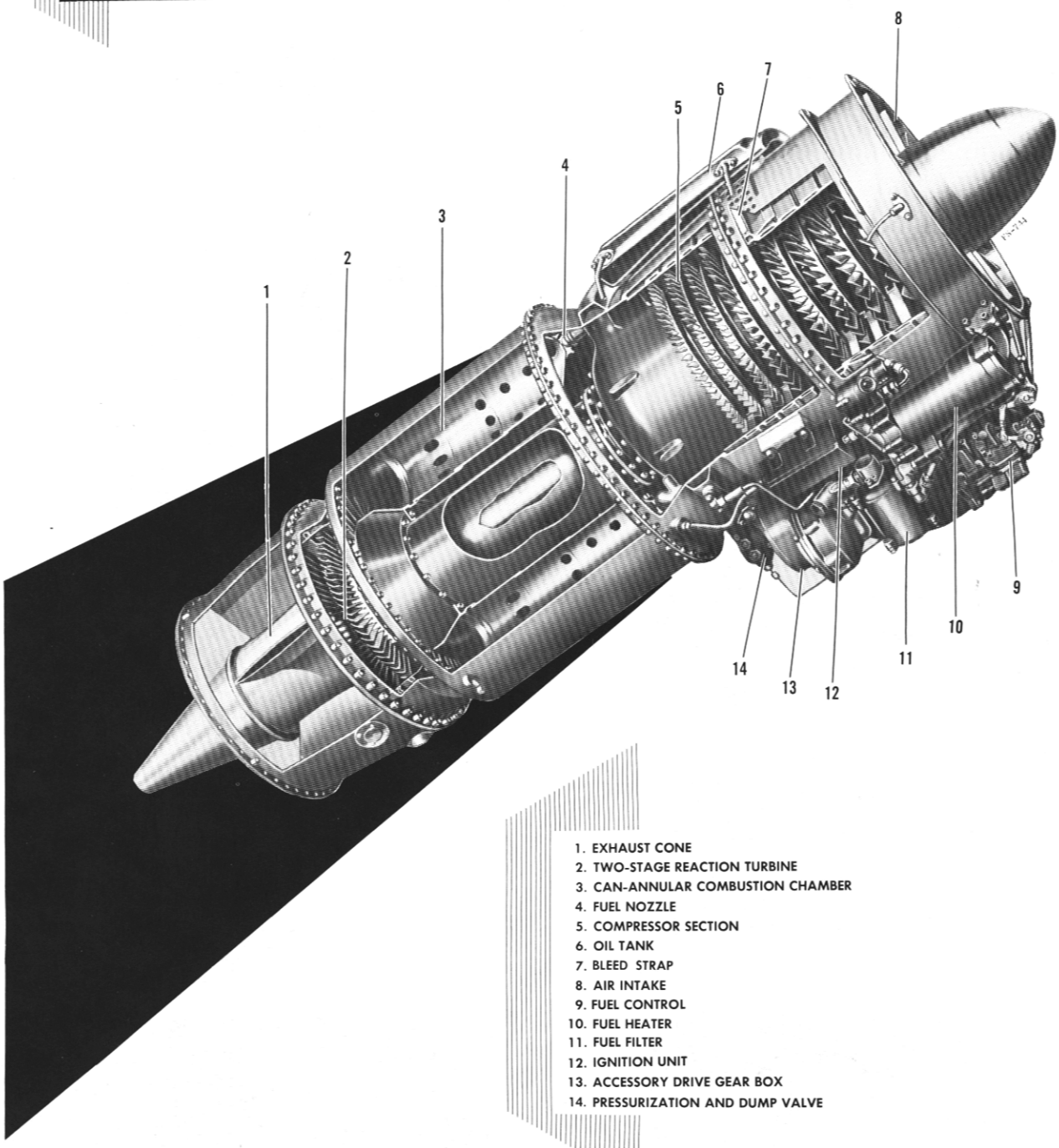


1. DOME LIGHT
2. ENGINE COMPUTER POUCH
3. INTERIOR LIGHT AND SPEAKER CONTROL PANEL
4. LIGHTING CONTROL PANEL
5. ANTI-ICE CONTROL PANEL
6. ELECTRICAL MASTER SWITCH
7. RADIO AND INSTRUMENT MASTER SWITCH
8. BAIL-OUT ALARM SWITCH
9. FUEL JETTISON SWITCH
10. HYDRAULIC CONTROL PANEL
11. WINDSHIELD WIPER CONTROL KNOB
12. MAGNETIC COMPASS
13. COMPASS CORRECTION CARD

T-39A-1-00-21E

Figure 1-6

J60 ENGINE (TYPICAL)



1. EXHAUST CONE
2. TWO-STAGE REACTION TURBINE
3. CAN-ANNULAR COMBUSTION CHAMBER
4. FUEL NOZZLE
5. COMPRESSOR SECTION
6. OIL TANK
7. BLEED STRAP
8. AIR INTAKE
9. FUEL CONTROL
10. FUEL HEATER
11. FUEL FILTER
12. IGNITION UNIT
13. ACCESSORY DRIVE GEAR BOX
14. PRESSURIZATION AND DUMP VALVE

T-39A-1-40-1D

Figure 1-7

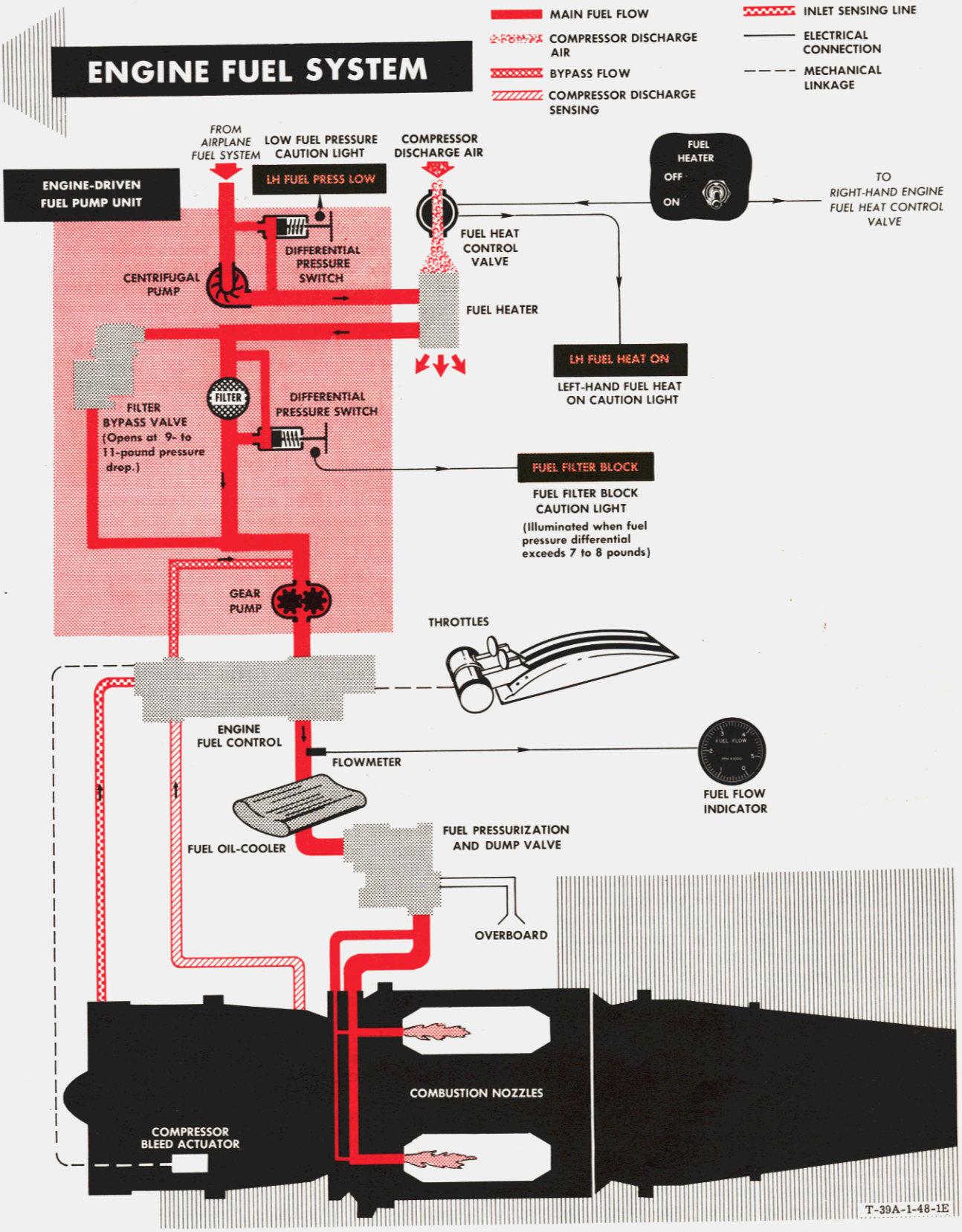

ENGINE FUEL SYSTEM
MAIN FUEL FLOW
COMPRESSOR DISCHARGE AIR
BYPASS FLOW
COMPRESSOR DISCHARGE SENSING
INLET SENSING LINE
ELECTRICAL CONNECTION
MECHANICAL LINKAGE
FROM AIRPLANE FUEL SYSTEM
LOW FUEL PRESSURE CAUTION LIGHT
COMPRESSOR DISCHARGE AIR
FUEL HEATER
OFF
ON
TO RIGHT-HAND ENGINE FUEL HEAT CONTROL VALVE
ENGINE-DRIVEN FUEL PUMP UNIT
LH FUEL PRESS LOW
DIFFERENTIAL PRESSURE SWITCH
CENTRIFUGAL PUMP
FUEL HEAT CONTROL VALVE
FUEL HEATER
LH FUEL HEAT ON
LEFT-HAND FUEL HEAT ON CAUTION LIGHT
FILTER
FILTER BYPASS VALVE (Opens at 9- to 11-pound pressure drop.)
DIFFERENTIAL PRESSURE SWITCH
FUEL FILTER BLOCK
FUEL FILTER BLOCK CAUTION LIGHT
(Illuminated when fuel pressure differential exceeds 7 to 8 pounds)
GEAR PUMP
THROTTLES
ENGINE FUEL CONTROL
FLOWMETER
FUEL FLOW INDICATOR
FUEL OIL-COOLER
FUEL PRESSURIZATION AND DUMP VALVE
OVERBOARD
COMBUSTION NOZZLES
COMPRESSOR BLEED ACTUATOR
T-39A-1-48-1E

Figure 1-8

occurs. This light is protected by a circuit breaker on the overhead circuit-breaker panel. (See figure 1-17.)

Fuel Heater.

A fuel heater (figure 1-8), installed on each engine upstream of the filter, is used to prevent the fuel filter from becoming blocked with ice with subsequent operation of the filter bypass. The fuel passes through the heater and is heated when compressor discharge air is passed through the heater. The compressor discharge bleed air to each engine is controlled by a motor-driven valve when the fuel heater switch is placed in the ON or OFF position. When the valves are not completely closed, the respective fuel heater caution light will come on.

Fuel Pressurization and Dump Valve.

The engine fuel pressurization and dump valve (figure 1-8) automatically directs fuel to one or both fuel manifolds, depending on engine operating conditions. At low flow, fuel passes through the primary manifold only. At high flows, both manifolds are used, with fuel flow through the secondary manifold being scheduled by the pressurizing valve as a function of the pressure drop across the primary manifold and nozzles. The dump portion of the valve is a two-position valve which is hydraulically actuated by a pressure signal from the fuel control. The pressure signal maintains the dump valve in a closed position during engine operation. On shutdown, fuel from the control is shut off immediately, the pressure signal drops rapidly, and the dump valve opens, permitting fuel in the manifold to drain overboard. On starting, the dump valve is again closed by the high-pressure signal.

Fuel Oil-cooler.

A fuel oil-cooler (figure 1-8) is installed on the engine to cool the engine lubricating oil. All engine fuel passes through the fuel oil-cooler, which is installed downstream of the hydromechanical fuel control. As the engine lubricating oil passes through the cooler, the heat is transmitted to the inlet fuel. No controls are provided for the fuel oil-cooler, as its function is automatic.

ENGINE AIR-BLEED SYSTEM.

The engine has two separate air-bleed systems: high-pressure air bleed and overboard air bleed. High-pressure air bleed is available for airframe use such as supply of the cabin pressurization and engine inlet duct and guide vane anti-icing systems. The overboard air-bleed system is required to prevent compressor instability. High-pressure air is bled from the engine through two ports on the diffuser-case bleed manifold. Interstage air from the fourth stage is bled overboard to preclude compressor instability at certain thrust conditions. A compressor bleed valve, within the compressor case, is actuated at predetermined conditions, as scheduled by the fuel control.

ENGINE PODS.

The engine pods (figure 1-1), one on each side of the aft fuselage section, are attached to the fuselage by pylon structures. Each engine pod houses the engine, inlet duct, four inlet duct flow straightener vanes, engine tail pipe, and engine accessories. The engine inlet duct assembly is attached to, and installed with, the engine, The flow straightener vanes aid in producing uniform airflow distribution at the engine face, thereby reducing the possibility of compressor stall under certain flight conditions. Each pod is equipped with an engine inlet duct and guide vane anti-icing system and with an overheat and fire detection warning system. On some airplanes, † each pod has an ice detector system. Anti-icing of the engine inlet and engine inlet duct is accomplished by bleeding air from the final stage of compression. This hot air is directed to the engine inlet duct, engine inlet guide vanes, bullet nose, and the four vanes of the engine inlet duct flow straightener. The pod is divided into two sections by a fire seal at the aft end of the compressor section, which separates the compressor section from the combustion and exhaust section.

In-flight cooling is provided by ram air to each compartment. On the ground, cooling is accomplished by convection circulation in the compressor compartment and by aspiration through the aft compartment. The aft compartment cooling air exits through an annular space around the exhaust nozzle opening. A fan in the starter-generator provides cooling-air circulation during ground operation of the unit and receives ram-air cooling during flight. Access to the engine is gained through four large removable engine access doors. The lower half of the engine pod and three access doors on the upper half are removable. The lower door hinges open for line maintenance and is easily removable for engine removal.

THROTTLES AND FRICTION LOCK.

Engine thrust is controlled by the throttle (figure 1-9). The throttles are mounted in a quadrant on top of the cockpit center pedestal where they are accessible to the pilot or copilot. The two throttles are connected to their respective engine fuel controls by mechanical linkage. A thumb-operated speed brake switch is mounted on the left engine throttle. Each throttle is provided with a separate safety latch, on the forward side of the throttle, which must be depressed before the throttle can pass from CLOSE to IDLE or from IDLE back into the CLOSE position. Both throttles are interlocked with the control surface gust lock so that only

†Airplanes not changed by T. O. 1T-39-767

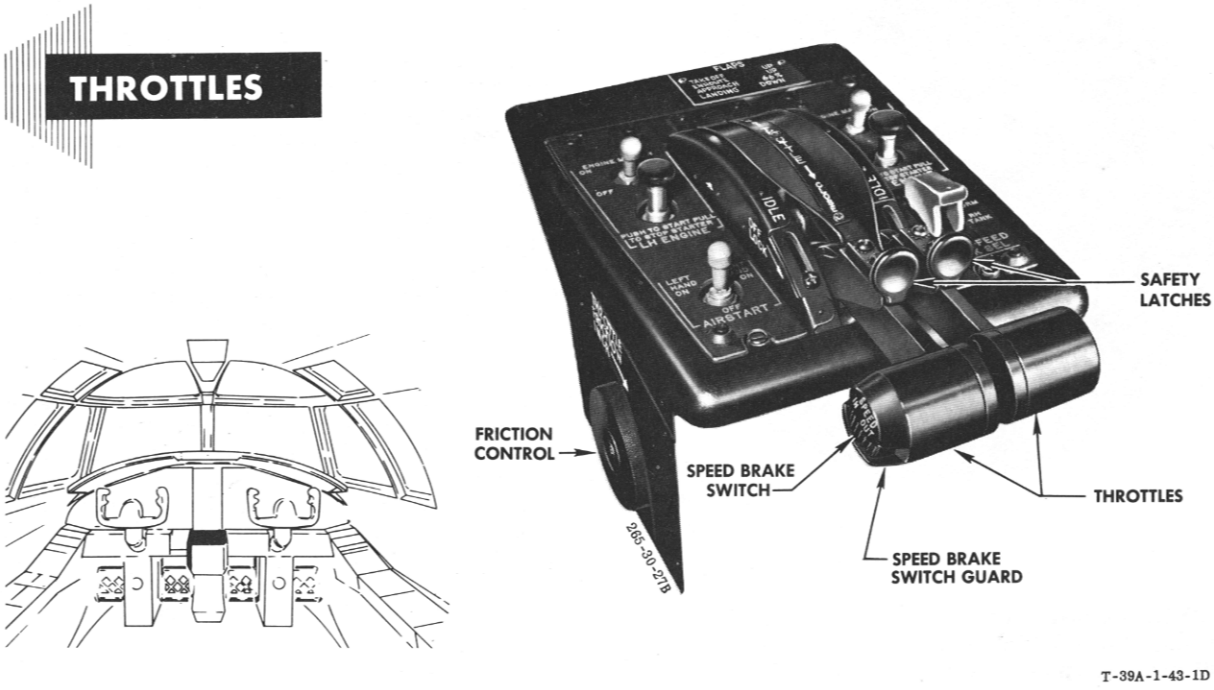


Figure 1-9

limited thrust is available when the gust lock is on. A friction control knob is provided on the pilot's side of the throttle quadrant. There are throttle-actuated microswitches in the quadrant that control the sequence of events in the fuel boost pump, engine ignition, landing gear warning circuits, and speed brake open caution light.

ENGINE MASTER SWITCHES.

A positive-position engine master switch (1 and 11, figure 1-5) is provided for each engine. These switches are on the forward end of the center pedestal, one on each side of the throttle quadrant. Moving the engine master switch to ON opens the respective engine fuel shutoff valve, and dc essential bus power is made available for subsequent starter operation. When both engine master switches are placed in the ON position, and both dc generators are on the line, power is available for operation of the wing and ram-air anti-icing system. With the selected engine master switch in the ON position, microswitches in the throttle quadrant are actuated when the respective throttle is moved out of the CLOSE position to energize the fuel boost pump and (provided the respective starter button is depressed) the engine ignition circuits. The engine master switches are powered from the dc essential bus and each is protected by a circuit breaker on the overhead circuit-breaker panel. (See figure 1-17.)

NOTE After engine shutdown, the engine master switch should be turned OFF before the electrical master and battery master switches are positioned at OFF. This allows the fuel shutoff valve to close.

STARTER BUTTONS.

Refer to "Starter System" in this section.

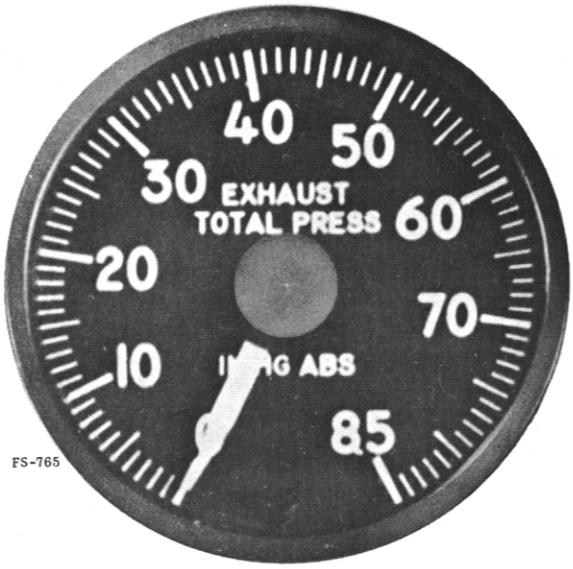
AIR START SWITCH.

Refer to "Starter System" in this section.

ENGINE INDICATORS.

Exhaust Total Pressure Gages.

The two exhaust total pressure gages are mounted on the engine instrument panel. These gages indicate turbine discharge total pressure, and are used in conjunction with the thrust curves to determine available thrust. Each gage is calibrated from 0



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to 85 in. Hg and is powered from the No. 1 26-volt ac bus. Electrical protection is provided by a circuit breaker on the overhead circuit-breaker panel.

Exhaust Gas Temperature Gages.

An exhaust gas temperature gage (21, figure 1-2) is provided for each engine. These two gages are mounted on the engine instrument panel, where they may be monitored by the pilot or copilot. The gages are calibrated, in 20° increments, from 0°C to 1000°C. The indicators provide the pilot with a visual indication of engine exhaust gas temperature. The gage system employs self-generating electrical units and does not require electrical power from the airplane for operation. For exhaust gas temperature gage limitation markings, see figure 5-1.

Oil Pressure Gages.

Refer to "Oil System Indicators" in this section.

Tachometers.

Two tachometers (20, figure 1-2) are mounted on the pilot's inboard instrument panel. Each tachometer is calibrated, in 2 percent increments, from 0 to 100 percent rpm, and registers engine speed in percentage of 16,030, which equals 100 percent rpm. The small dial within the larger dial is provided so that the pilot may more easily read the exact rpm percent; i.e., when the large pointer is between 90 and 100, and the pointer on the small dial is at 3, the rpm percent is 93. Each tachometer receives power from its respective tachometer generator which is geared to the engine accessory section driven by the compressor rotor. The tachometer is, therefore, independent of the airplane electrical system.

Engine Synchronization Indicator.†

An engine synchronization indicator is installed on the copilot's inboard instrument panel, just above the left bank of the caution-warning light panel. It has a double-end pointer which will rotate either clockwise or counterclockwise through 360 degrees. On the face of the indicator are the words "SLOW" and "FAST," each associated with a curved arrow. When the pointer rotates counterclockwise ("SLOW"), this means the right engine is running slower than the left engine. Pointer rotation clockwise ("FAST") indicates the right engine is running faster than the left engine. The pointer rotates when the speed differential between the two engines is 4 percent or less. When the engines are in exact synchronization, the pointer stands still.

The indicator is operated by electrical signals generated by the left and right engine-driven tachometer generators. The signal from the left engine tachometer generator is utilized as the master signal. The signal from the right engine tachometer generator, when out of synchronization with that from the left engine tachometer generator, causes the pointer to rotate in the direction corresponding to faster or slower right engine speed.

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Fuel Flow Indicators.

The two fuel flow indicators (52, figure 1-2) are mounted on the pilot's inboard instrument panel. The flow indicators show the rate of fuel flow from the fuel control unit to the engine in pounds per hour. The gages are calibrated, in 100-pound increments, from 0 to 5000 pounds per hour. For fuel flow

† Airplanes changed by T.O. 1T-39A-549

indicator limitation markings, see figure 5-1. The indicators are powered from the ac essential bus and are protected by separate push-pull circuit breakers on the overhead circuit-breaker panel.

STARTER SYSTEM.

Engine starts may be made by use of the airplane batteries or external power, or by air starting. A combination starter-generator operates as a starter until engine speed reaches approximately 28 to 35 percent rpm. At this time, the starter ceases to torque the engine and the solenoid-held push-pull starter button is automatically released, indicating the cranking cycle is ended. As engine rpm increases, the starter-generator begins to function as a generator, and the generator output is automatically connected to the dc bus system. During a battery start, the two 24-volt batteries are automatically connected in series. One battery also supplies voltage to the battery bus. During an external power start, the batteries are disconnected (by insertion of the external power plug) from the starting bus.

Starter Buttons.

A solenoid-held, push-pull starter button (2 and 12, figure 1-5) is provided for each engine. Each button is labeled "PUSH TO START PULL TO STOP STARTER." These buttons are on the engine switch panels, one on each side of the throttle quadrant, and are used when normal battery or external power starts are made. When the starter button is actuated, a solenoid holds the button down during the cranking portion of the starting cycle. Starter operation is entirely automatic after the starter button has been pushed in. Should the engine fail to start or if it is desired to stop the starting cycle, the starter button may be manually pulled up. The starting system is designed so that either engine may be started first. A relay in the starter controller automatically de-energizes the ignition and releases the starter button when the engine has accelerated to approximately 28 to 35 percent rpm and the starter load has decreased to approximately 200 amperes when external electrical power is used for starting. During battery starts, the rpm may be somewhat higher. There is a red ignition-on light in each starter button which illuminates during ground or air engine starting to show when ignition is on. This light goes out when ignition is no longer provided.

Air Start Switch.

An air start switch (3, figure 1-5) is on the left engine switch panel. This switch has three positions: LEFT HAND ON, OFF, and RIGHT HAND ON, and is to be used for air starting of either engine. When the switch is actuated for either engine, dc power is supplied directly from the dc essential bus to the respective engine ignition unit when the respective throttle is advanced from the CLOSE position. The ignition-on light, in the engine starter button, is illuminated in the same manner as during a normal engine start; however, the light will remain on until the air start switch is placed in the OFF position. After an engine air start, as indicated by engine exhaust gas temperature and rpm, the air start switch must be replaced to the OFF position.

NOTE When the air start switch is placed at LEFT HAND ON or RIGHT HAND ON, the respective dc generator is taken off the line and may have to be reset when the air start switch is returned to the center (OFF) position.

IGNITION SYSTEM.

The dc essential bus-powered ignition system, providing ignition through two sparkigniter plugs on each engine, functions during ground starts and air starts. Movement of the throttle from CLOSED to IDLE, during the normal engine starting sequence, actuates a switch which completes the engine ignition circuit. This throttle action also causes the fuel boost pump to operate. The sparkigniters are in the No. 3 and No. 6 burners. After burning occurs in No. 3 and No. 6 burners, the remaining burners are ignited through the interconnecting flame tubes. After initial starting, combustion is continuous.

OIL SYSTEM.

Each engine has a self-contained engine oil lubricating system consisting of an oil tank, an oil pressure pump, an oil filter, engine scavenge pumps, and a fuel oil-cooler. The oil serves both for lubricating and cooling. Operation of the oil system is completely automatic, requiring no control action by the flight crew. The oil tank capacity is 1.6 US gallons plus expansion space. The oil tank is mounted on the engine over the compressor section. An oil servicing access door is provided on the upper forward surface of each engine pod. The engine oil pump is on the engine accessory gearbox, and an oil pressure of 45 (±5) psi, relative to internal breather pressure (tank pressure), is maintained by an oil pressure relief valve downstream of the oil filter. Oil scavenge pumps are provided to pick up oil from the bearing compartments and gearbox and return it through the fuel oil-cooler back to the oil tank. Refer to servicing diagram (figure 1-31) for engine oil specification and grade.

OIL SYSTEM INDICATORS.

Oil Pressure Gages.

The two oil pressure gages (51, figure 1-2) are mounted near the bottom of the center instrument panel and are calibrated, in increments of 5 psi, from 0 to 100 psi. These gages show the pressure of oil within the engines and are powered from the 26-volt No. 1 ac bus. Each oil pressure indicating system is protected by a circuit breaker on the overhead circuit-breaker panel. (See figure 1-17.) For oil pressure gage limitation markings, see figure 5-1.

Oil Overheat Caution Lights.

The "LH OIL OHEAT" and "RH OIL OHEAT" amber caution lights (figure 1-26) are on the caution-warning light panel. These lights are controlled by temperature switches mounted in each engine gear box. In case the oil temperature exceeds 121°C, the temperature switches close and the respective engine oil overheat caution light will come on.

Low Oil Pressure Caution Light.

The "OIL PRESS LOW" amber caution light (figure 1-26) is on the caution-warning light panel. This light is actuated by a pressure switch in either engine oil system. When engine oil pressure drops to 28 (±1) psi, the pressure switch closes and the low oil pressure light will come on. When pressure is greater than 32 psi, the switch opens and the low oil pressure light will go out. This light is protected by a single push-pull circuit breaker on the overhead circuit-breaker panel.

AIRPLANE FUEL SYSTEM.

The airplane fuel system (figure 1-10) consists of two separate fuel tanks in the wing and a fuselage tank mounted in the aft fuselage compartment. Each wing has a fueltight compartment which serves as a fuel tank. The wing is divided into two separate fuel tanks by a center bulkhead; each tank extends from the center bulkhead outboard to the wing tip rib, thus providing a separate fuel supply system for each engine. A tank cross-feed valve is installed in the center bulkhead to permit utilization of fuel from both wing tanks by one engine or one boost pump. Each wing tank contains three baffle plates that have check valves which allow fuel to flow by gravity feed toward the center section. A fuel ejector and a boost pump are mounted in each wing near the center bulkhead. To ensure automatic after-shutdown protection from thermal expansion, thermal relief is provided in

AIRPLANE FUEL SYSTEM

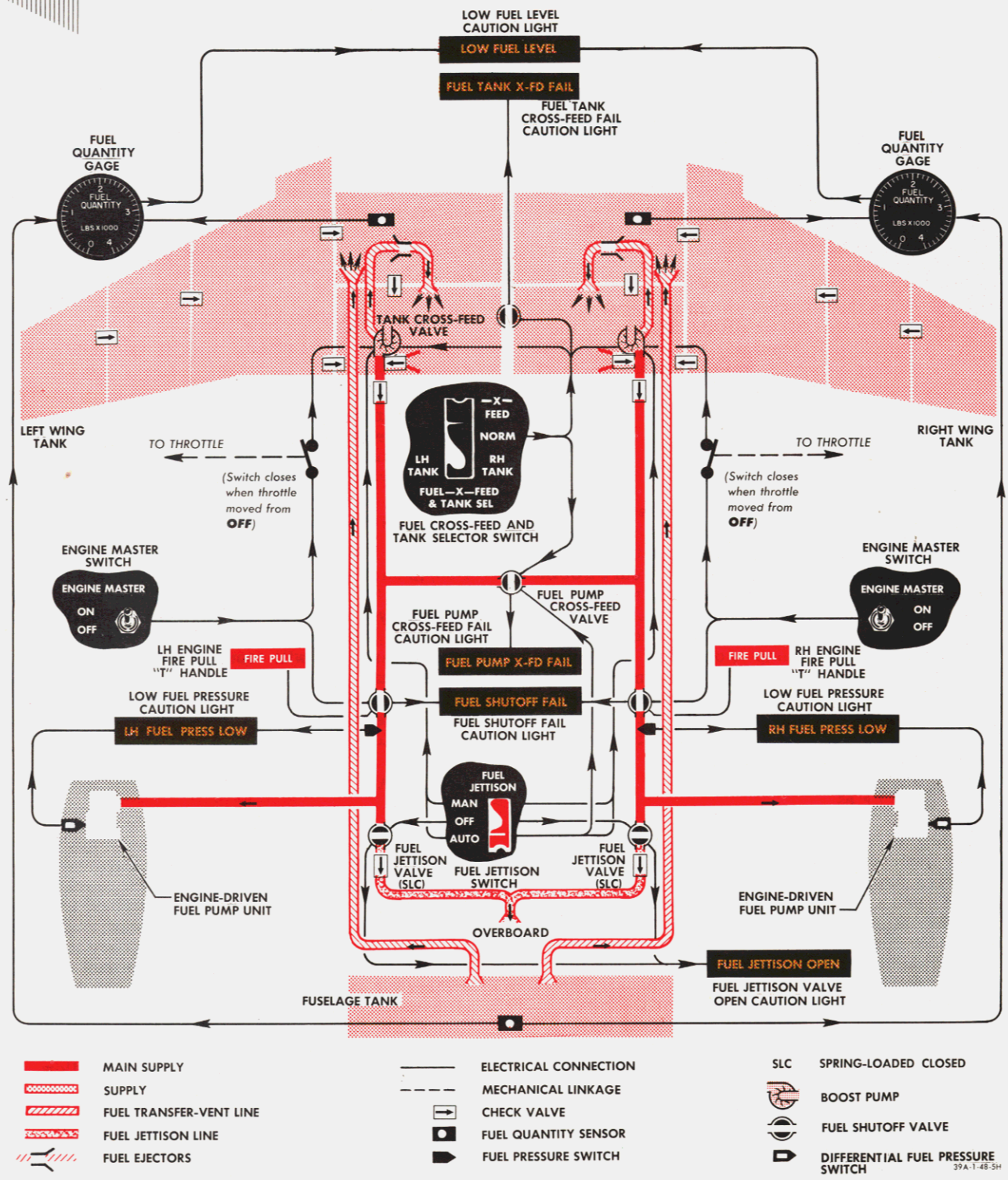

Figure 1-10

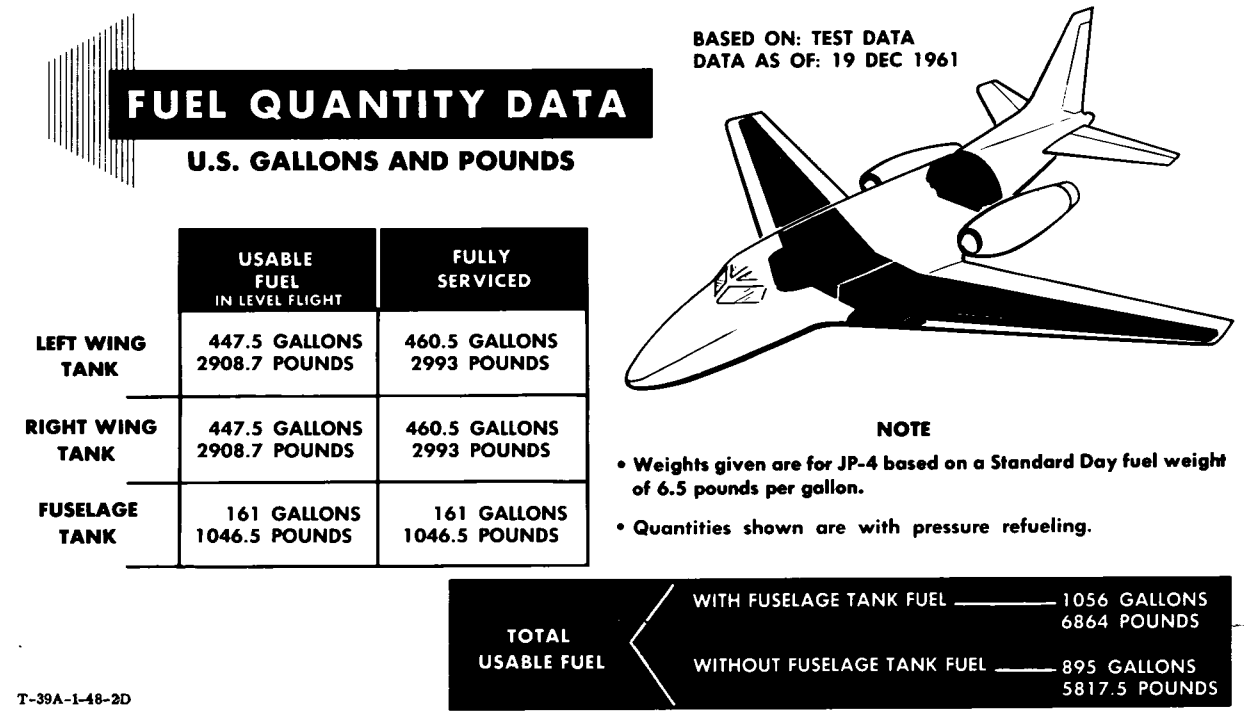

Figure 1-11

the fuel shutoff and upstream check valve. For gravity and single-point refueling procedures, refer to Section IV of this manual. Fuel tank capacities are listed in figure 1-11; fuel specifications are given in figure 1-31.

FUSELAGE TANK.

A bladder-type fuselage tank, mounted in a liquid-tight sealed metal compartment in the aft fuselage equipment compartment, has a capacity of 163 US gallons (1059.5 pounds) of usable fuel by gravity refueling and 28 US gallons of expansion space. During pressure refueling, automatic shutoff will occur at 161 US gallons (1046.5 pounds). This fuel drains by gravity feed through separate lines into both wing tanks. The fuselage tank is provided with a dual integral level control shutoff valve with dual test diaphragms to admit fuel to the tank during single-point pressure refueling. This tank may also be serviced through a gravity-flow type fuel filler cap, on the upper right side of the fuselage, if single-point pressure refueling facilities are not available. When fueling the airplane for total fuel capacity (wing and fuselage tank) and using the gravity refueling method, the system should be fueled from the fuselage tank. By holding each wing gravity fuel filler cap flapper valve depressed while filling from the fuselage filler receptacle, the wing tanks will fill at the same time. As fuel rises to the level of the flapper valves, they must be released and then the fuselage tank filled to the required level. Any time expansion occurs in the wing, the expanding fuel is vented to the fuselage tank. The expansion space in the fuselage tank serves as a liquid separator, retaining any liquid fuel which may pass from the wing into the vent lines. This fuel also flows back into the airplane fuel system as fuel is used. The fuselage tank is vented overboard through a vent which extends directly aft out of the fuselage. An antisiphon line and check valve are installed in the fuselage tank to prevent siphoning during thermal expansion.

FUEL TANK VENTING.

The fuel system is vented internally and to the atmosphere to maintain a satisfactory pressure condition during any static or flight condition. The wing tanks are vented, compartment-to-compartment, and to the fuselage tank. The fuselage tank is vented to the atmosphere through a vent line which extends aft out through the tail cone into the screened-in area around the fuel jettison pipe. The primary purpose of the vent is to provide a proper balance of pressure within each fuel tank to prevent the tank collapsing or expanding beyond limits, and to ensure proper fuel transfer. Separate vent exhausts, incorporated in the single-point wing refueling level control pilot and vent valves on each wing tip, prevent excessive pres-

sure build-up during pressure refueling. A climb vent line, installed between the wing tanks and the fuselage tank, improves fuel transfer during climb and will expedite completion of transfer when level flight is attained.

FUEL BOOST PUMPS.

The submerged centrifugal boost pump in the aft center section (hopper compartment) in each wing tank supplies fuel under pressure, through the fuel shutoff valve, to its respective engine fuel system. Each fuel boost pump is energized whenever its respective engine master switch is ON and its respective throttle is advanced from the OFF position. Whenever the fuel cross-feed and tank selector switch is positioned at CROSS-FEED (labeled "X-FEED"), both boost pumps are energized, provided one engine master switch is ON and the corresponding throttle is advanced to IDLE or above. The airplane is equipped with a fuel pump cross-feed valve which connects the two fuel systems, allowing either fuel boost pump to supply fuel to both engines. The boost pumps are powered by the dc essential bus, and are protected by a circuit breaker on the overhead circuit-breaker panel. (See figure 1-17.)

FUEL TRANSFER EJECTOR.

One fuel transfer ejector is installed in each wing fuel tank in the forward lower portion of the tank near the center bulkhead. The purpose of the ejector is to scavenge fuel from that area and direct it to the boost pump area. One-way check valves, installed in the baffle surrounding the boost pump, permit fuel flow into the compartment. The scavenged fuel is directed into this compartment to ensure availability of fuel to the boost pump. The ejectors are self-contained units which have no moving parts and operate by bleeding a portion of the boost pump flow through the submerged ejector which picks up fuel (venturi action) and directs it to the boost pump compartment.

FUEL HEATER.

Refer to "Engines" in this section.

FUEL CROSS-FEED AND TANK SELECTOR SWITCH.

The fuel cross-feed and tank selector switch (13, figure 1-5) is on the right engine switch panel. The switch is powered by the dc essential bus and has four positions: NORM, X-FEED, LH TANK, and RH TANK. For all normal operations, the switch is in the guarded NORM position. In case of low fuel pressure, as indicated by the left or right low fuel pressure caution lights, the switch is placed at the CROSS-FEED position. Selecting the CROSS-FEED position opens the fuel tank and fuel pump cross-feed valves and permits the operable boost pump to supply the necessary fuel pressure. If the low fuel pressure caution light goes out, this indicates that a tank boost pump has failed. If the caution light stays on after the CROSS-FEED position is selected, this indicates that the engine-driven centrifugal boost pump has failed. The LH TANK and RH TANK positions are for the purpose of wing fuel balancing. Selecting the LH TANK or RH TANK position de-energizes the wing boost pump in the opposite wing tank, maintains the tank cross-feed valve closed, opens the fuel pump cross-feed valve, and energizes the selected wing tank boost pump. For wing fuel balancing procedures, refer to "Airplane Fuel System Failure" in Section III and "Fuel System Management" in Section VII.

LOW FUEL PRESSURE CAUTION LIGHTS.

The "LH FUEL PRESS LOW" and "RH FUEL PRESS LOW" amber caution lights (figure 1-26) are on the caution-warning light panel. They are actuated by either of two pressure switches. One is downstream of the fuel shutoff valve, indicating tank boost pump output; the second pressure switch (differential pressure) indicates a differential pressure decrease across the engine-driven centrifugal boost pump. Either tank boost pump supplies adequate fuel pressure for two-engine operation.

LOW FUEL LEVEL CAUTION LIGHT.

The "LOW FUEL LEVEL" amber caution light (figure 1-26) is on the caution-warning light panel. Circuit protection is provided by a circuit breaker on the overhead circuit-breaker panel. This light receives its signal from either fuel quantity gage and is energized when either fuel quantity gage indicates approximately 300 pounds remaining. However, when the fuel quantity switch is in the RH IND, RH WING, LH IND AUX position, the light will come on only when there is less than approximately 300 pounds of fuel in the right wing.

FUEL TANK CROSS-FEED FAIL CAUTION LIGHT.

The "FUEL TANK X-FD FAIL" amber caution light (figure 1-26) is on the caution-warning light panel. This light is protected by a circuit breaker on the overhead circuit-breaker panel. (See figure 1-17.) The purpose of the fuel tank cross-feed fail light is to monitor the position of the tank cross-feed valve, in the wing center bulkhead; when the valve position does not correspond with the switch position, the caution light will come on.

FUEL PUMP CROSS-FEED FAIL CAUTION LIGHT.

The "FUEL PUMP X-FD FAIL" amber caution light (figure 1-26) is on the caution-warning light panel. This light is protected by a circuit breaker on the overhead circuit-breaker panel. (See figure 1-17.) The purpose of the fuel pump cross-feed fail light is to monitor the position of the pump cross-feed valve, downstream of the boost pumps. When the valve position does not correspond with the position of the fuel cross-feed and tank selector switch or the fuel jettison switch, the caution light will come on.

FUEL SHUTOFF FAIL CAUTION LIGHT.

The "FUEL SHUTOFF FAIL" amber caution light (figure 1-26) is on the caution-warning light panel. It comes on when either or both fuel shutoff valves are not in a fully open or closed position as selected by the engine master switches or fire pull "T" handles.

FUEL QUANTITY SWITCH.

The fuel quantity switch (figure 1-12) is above the thrust indicators on the pilot's inboard instrument panel. The switch has three positions: TEST; TOTAL (center); and RIGHT-HAND INDICATOR, RIGHT-HAND WING, LEFT-HAND INDICATOR AUXILIARY (labeled "RH IND, RH WING, LH IND AUX"). When the switch is moved to the left, the indicator needles of both fuel quantity indicators should rotate counterclockwise. The function of this position is to test both fuel quantity indicating systems for proper operation by driving both needles away from their true indications. When the switch is placed back in the center position, the needles should return to their former positions. When the switch is moved to the right, the left fuel quantity indicator shows usable fuel in the fuselage fuel tank, and the right fuel quantity indicator shows usable fuel in the right wing.

FUEL QUANTITY GAGES.

Two fuel quantity gages (53, figure 1-2), on the pilot's inboard instrument panel, indicate in pounds of fuel. The gages are calibrated from 0 to 4000, in increments of 100 pounds. These gages indicate the total usable internal fuel supply. Each gage reads the fuel quantity in one wing tank plus one half the total fuselage tank fuel, regardless of the temperature or type of fuel. The total quantity of the fuselage fuel tank may be read on the left fuel quantity indicator. (Refer to "Fuel Quantity Switch.")

Figure 1-12

NOTE Fuel indications may vary in error as much as 200 pounds relatively quickly because of changes in airplane attitude during a penetration or approach. The same error indication will also apply to a prolonged nose-up attitude with partial fuel load; however, in the nose-up attitude, the error will be indicated at a much slower rate.

- Fuel indications can be affected when the radio and engine instrument indirect light rheostat is turned on. Readings could be as much as 200 pounds (total fuel) high, depending on light intensity and fuel remaining.

The fuel quantity indicating system is powered by the 115-volt ac essential bus. Circuit protection is provided by two circuit breakers on the overhead circuit-breaker panel. (See figure 1-17.)

FUEL JETTISON SYSTEM.

The airplane is equipped with a fuel jettison system which may be used in any airplane flight attitude or configuration. Normally, fuel is jettisoned at the rate of approximately 180 pounds per minute, depending on altitude, temperature, and thrust setting, and is automatically stopped when the total fuel remaining is 1400 to 2200 pounds. A manual method of jettisoning fuel provides the flight crew with an alternate means of fuel jettison in case of a malfunction of relays or float switches, or will allow additional fuel to be jettisoned. Fuel jettisoning may be used when it is desirable to land with the lightest possible load.

NOTE When either main gear oleo is compressed, the circuit to the fuel jettison switch is opened, preventing fuel jettisoning while the weight of the airplane is supported by the landing gear.

Fuel Jettison Switch.

The fuel jettison switch (9, figure 1-6) is on the overhead control panel. The switch is powered by the dc essential bus and has three positions: AUTO, OFF, and MAN. When the fuel jettison switch is placed at either the AUTO or the MAN position, the fuel pump cross-feed valve opens, the fuel tank cross-feed valve remains unmoved, the two fuel jettison valves open, the "FUEL

JETTISON OPEN" and master caution lights come on, and fuel jettison begins. When the fuel jettison switch is placed at the AUTO position, the two fuel jettison valves and the fuel pump cross-feed valve close when the fuel level in either wing tank decreases to 700-1100 pounds.

Regardless of the position of the fuel cross-feed and tank selector switch, both boost pumps will be energized when the fuel jettison switch is at either AUTO or MAN position and fuel will be jettisoned from both wing tanks.

Caution When the switch is held in the spring-loaded MAN position, fuel jettisoning will continue until the fuel jettison switch is released or all fuel is jettisoned.

Fuel Jettison Open Caution Light.

The "FUEL JETTISON OPEN" amber caution light (figure 1-26) is on the caution-warning light panel. This light comes on when the fuel jettison switch is placed at either the AUTO or the MAN position (provided that either fuel jettison valve opens). When jettisoning is completed, the jettison valves close and the caution light goes out.

ENGINE MASTER SWITCHES.

Refer to "Engines" in this section.

THROTTLES AND FRICTION LOCK.

Refer to "Engines" in this section..

ENGINE FIRE PULL "T" HANDLES.

Refer to "Engine Fire-extinguishing System" in this section.

ELECTRICAL POWER SUPPLY SYSTEMS.

The 28-volt direct-current system is powered by two 30-volt, 300-ampere engine-driven starter-generators, one on each engine. Two 24-volt, 22-ampere-hour nickel-cadmium batteries furnish stand-by power for the dc system, and can be used for engine start when an external power source is not available. Both batteries are connected in parallel to the dc system; but during a battery-powered start, the batteries are series-connected, with the combined voltage of both batteries applied to the starters. Alternating current is supplied by a dc-powered, main 3-phase, 1500-volt-ampere inverter, with a dc-powered stand-by 3-phase inverter, capable of 500-volt-ampere capacity, incorporating an automatic change-over system. The change-over also can be manually selected. Two engine-driven ac generators, one on each engine, provide power only for heating the two forward windshields. (Refer to "Windshield Anti-icing System" in Section IV.) For ground operations, external power can be supplied to the dc system and to the starter circuit.

DC ELECTRICAL POWER DISTRIBUTION.

DC power is distributed from the following electrical busses: battery bus, paralleling bus, dc essential bus, and No. 1 and No. 2 dc secondary busses. In addition, there is a starter bus to supply power to the starters only. (See figure 1-13.)

Battery Bus.

The battery bus (figure 1-13) is connected directly to the batteries and is energized as long as battery power is available. During normal operation, the battery bus is powered by both batteries connected in parallel. However, when a battery-powered engine start is made, battery No. 2 is disconnected automatically from this bus, and the batteries are then series-connected to supply the higher voltage demands of the starters. During this period, battery No. 1 continues to supply the battery bus. The battery bus can be connected to, and power, the paralleling bus and the dc essential bus during ground operation, or the dc essential bus in flight (both generators inoperative).

Starter Bus.

The starter bus (figure 1-13) is powered by both batteries connected in series during a battery-powered engine start, or by external power through the starter external power receptacle. During an external power start, the batteries are not connected to the starter bus.

Paralleling Bus.

The paralleling bus (figure 1-13) can be energized by the battery bus, dc generators, or utility external power. Normally, the paralleling bus powers all other dc busses, except the starter bus. The paralleling bus is energized if power is available from either dc generator. On the ground, the paralleling bus in energized directly by utility external power, or by the battery bus if the electrical master and battery switches are ON.

DC Essential Bus.

The dc essential bus (figure 1-13) is normally energized by the paralleling bus if either dc generator is on the line. Also, on the ground, the essential bus is energized through the paralleling bus by battery bus power if the electrical master and battery switches are ON, or by utility external power. In flight, if both dc generators fail or are off the line, the essential bus automatically becomes powered directly from the battery bus. If this automatic power transfer fails, the dc essential bus can be connected to the battery bus by setting the battery switch at its ESSENTIAL position.

NOTE The sealed batteries in the interior emergency lighting system power units are kept charged by the dc essential bus. If the essential bus fails, these batteries illuminate the emergency lights. (See figure 1-13

and refer to "Emergency Lighting" in this section.)

DC Secondary Busses.

The No. 1 and No. 2 dc secondary busses (figure 1-13) are energized by the paralleling bus if both dc generators are on the line, or if utility external power is applied. Therefore, if power is available from only one dc generator, both dc secondary busses are de-energized.

Electrical Master Switch.

The two-position electrical master switch (figure 1-6), on the overhead panel, controls all dc power except the battery bus. When the switch is at ON, battery bus power is supplied to the battery switch to make it effective, and the contacts of the reverse-current relays can close when dc generator output is available to put the generators on the line. Moving the electrical master switch to OFF takes the dc generators off the line by opening the contacts of the reverse-current relays, and power is removed from the battery switch.

Battery Switch.

The battery switch (figure 1-14), on the copilot's inboard instrument panel, controls battery bus power to the dc bus system, but is effective only if the electrical master switch is ON. When the battery switch is at ON, a bus tie-in relay connects the battery bus to the paralleling bus. In flight, this relay closes only if either dc generator is on the line. Therefore, if both dc generators fail in flight or are turned off, the paralleling bus is disconnected automatically from the battery bus and the paralleling bus can no longer power the dc essential bus. When this occurs, an emergency relay is actuated if the electrical master and battery switches are ON, to ensure that the dc essential bus remains energized by connecting it directly to the battery bus. Should this automatic power transfer system fail, moving the battery switch to ESSENTIAL (labeled "ESSENT") energizes the essential bus emergency relay to connect the dc essential bus to the battery bus.

Caution The contacts of the essential bus emergency relay are used in flight only when the relay is energized by either of these two emergency transfer methods. To prevent unnecessary use of the relay, the ESSENTIAL position of the battery switch should be used in flight only as required.

Whenever the battery switch is at OFF, the battery bus is disconnected from the paralleling bus, and if both dc generators are off the line, the battery bus is the only dc bus to remain energized. If the battery switch is turned OFF, and both dc generators are on the line, all dc busses (except the starter bus) remain energized.

DC Generator Switches.

The left and right dc generator switches (figure 1-14), on the copilot's inboard instrument panel, control the dc generators, provided the electrical master switch is ON. When the engine speed is above approximately 40 percent rpm, and the dc generator switch is ON, the respective dc generator powers the system. If dc generator voltage becomes excessive (31 to 33 volts), an overvoltage relay cuts the affected generator out of the circuit. Then the switch may be held at RESET momentarily and released to ON in an attempt to restore generator operation. When a dc generator switch is OFF, the corresponding generator is off the line. The dc generator switches are spring-loaded from RESET to OFF.

NOTE During engine start (ground or air), or when the engine master switch is at OFF, or when the engine fire pull "T" handle is actuated, the corresponding dc generator is taken off the line, regardless of the setting of the dc generator switch.

DC Generator-off Caution Light.

The "DC GEN OFF" amber caution light (figure 1-26) is on the caution-warning light panel. It comes on when either dc generator has failed or is taken off the line because of overvoltage or undervoltage. Because one light is used for both dc generators, it is necessary to refer to the dc loadmeters to determine which generator is not on the line. (The failed generator will have a zero loadmeter reading, and the operational generator will have a high loadmeter reading.) The generator-off caution light will come on during engine start until engine speed is at idle, both generators are operating normally, and the external power unit has been disconnected.

DC Generator Overheat Caution Lights. †

The "RH DC GEN OHEAT" and "LH DC GEN OHEAT" amber caution lights (figure 1-26), are on the caution-warning light panel. These lights come on when the respective dc generator is overheated. During prolonged engine cranking, a generator overheat light may come on, but it should go out when the start is obtained. If an overheat light comes on in flight, the affected generator should be turned off to relieve the generator from all electrical loads. The respective overheat light will stay on after the affected generator has been turned off and will go out only after the generator has cooled.

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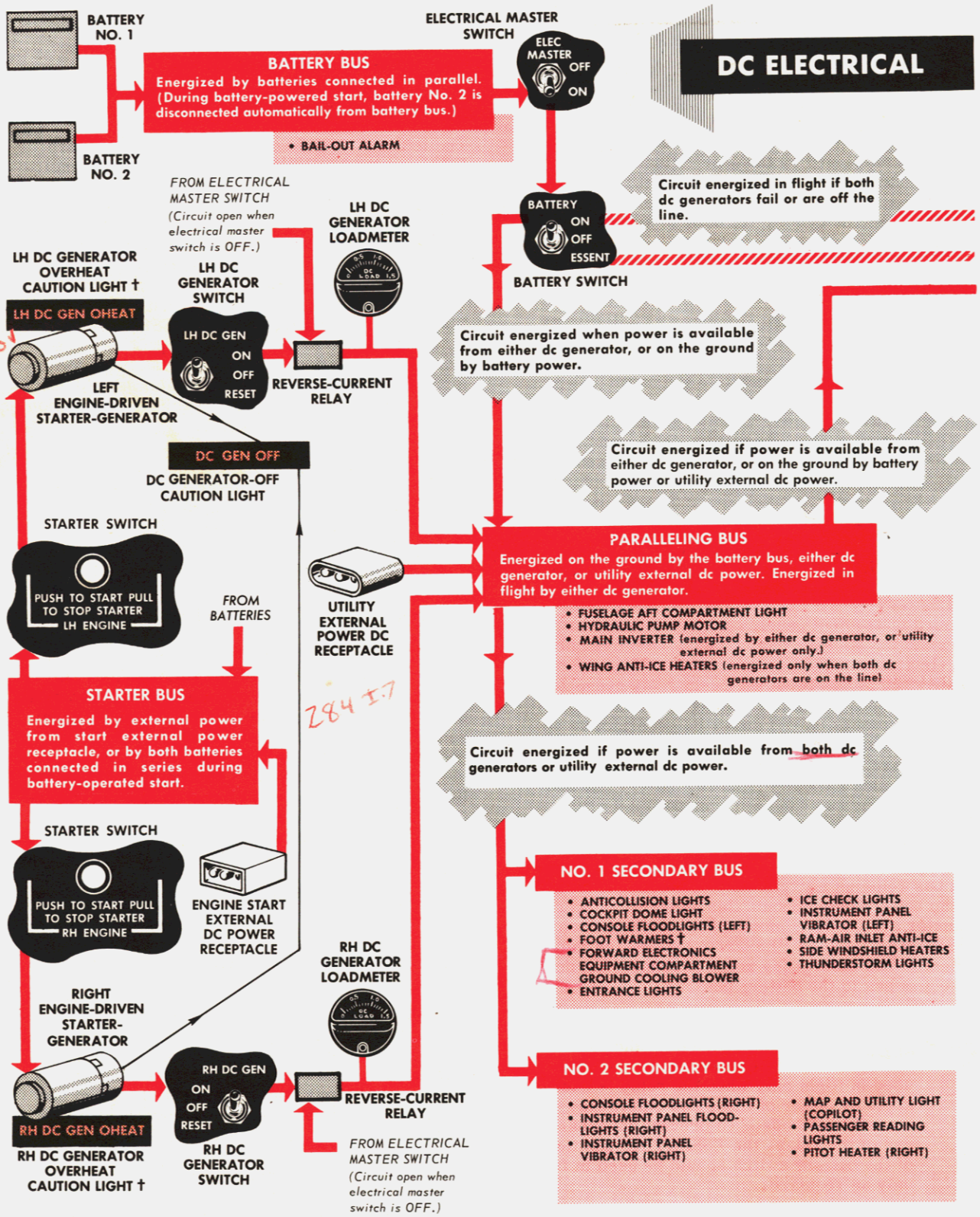
†Airplanes not changed by T. O. 1T-39-774



†Some airplanes (Refer to applicable text).

39A-1-54-18H

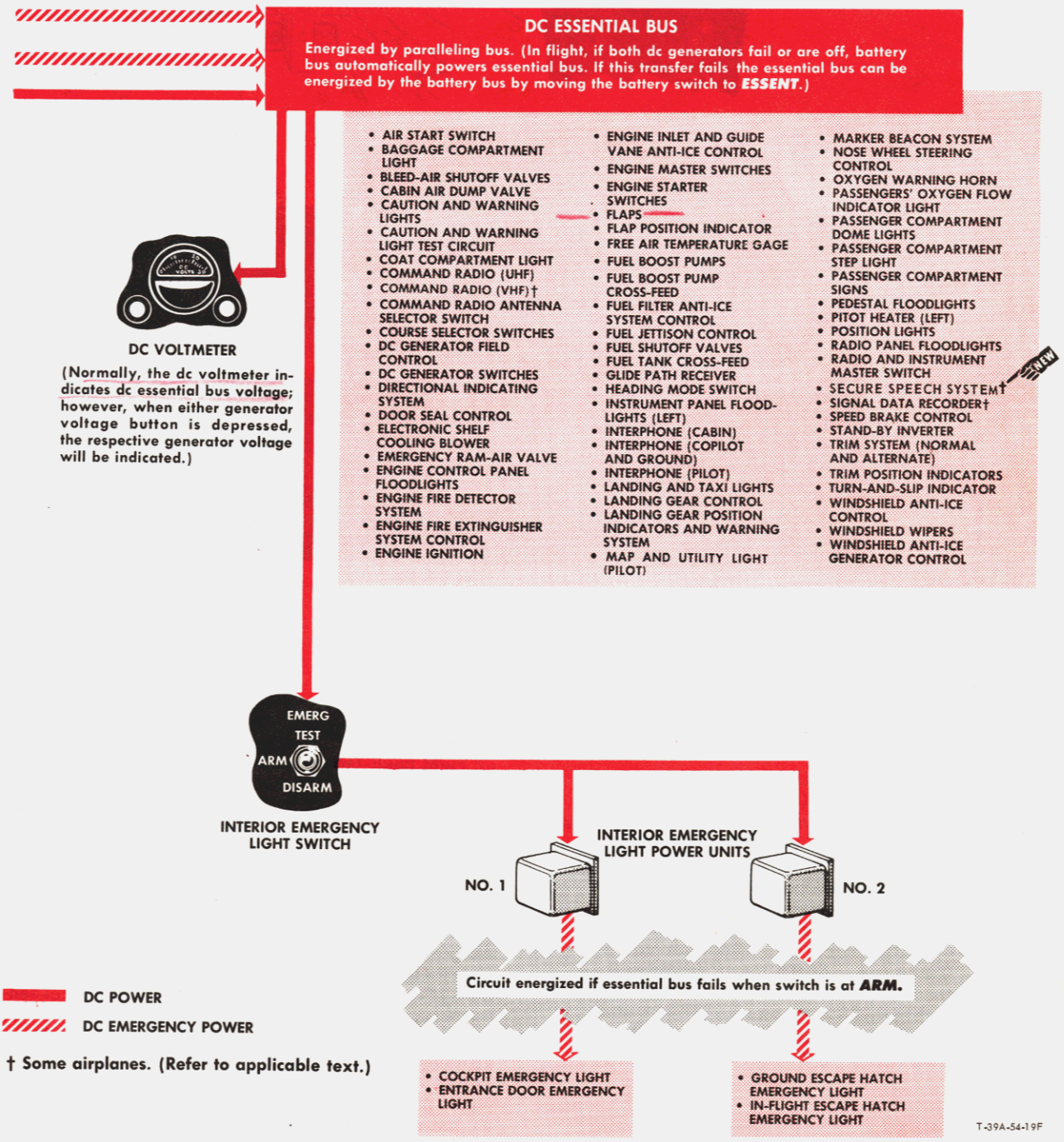
Figure 1-13

POWER DISTRIBUTION

(FUNCTIONAL FLOW DIAGRAM)

NOTE

Systems using more than one power source are listed only under the ac or dc bus that would normally be lost first.



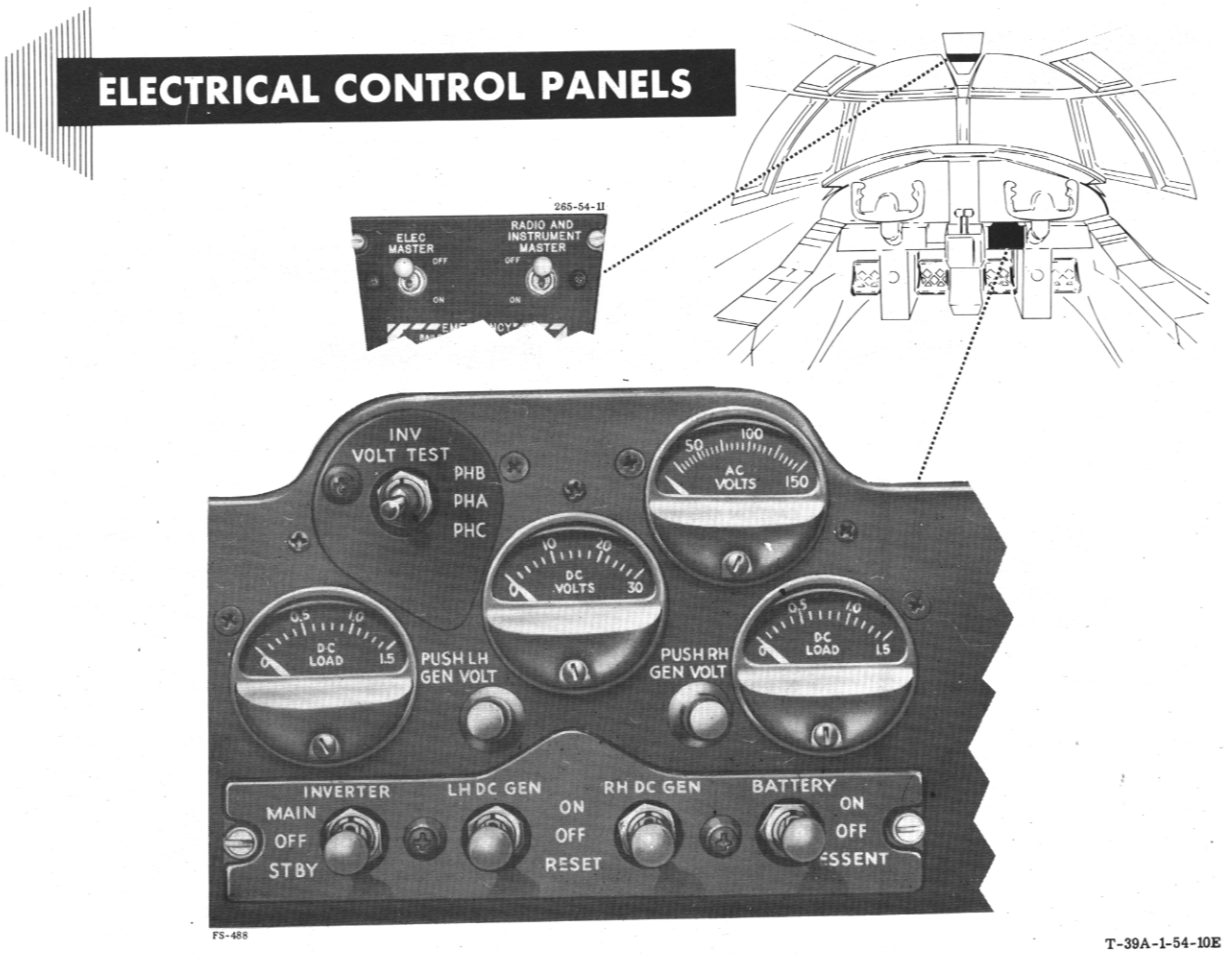


Figure 1-14

DC Loadmeters.

The left and right dc loadmeters, on the copilot's inboard instrument panel (figure 1-14), show the electrical load being drawn from the corresponding dc generators in terms of percentage of the nominally rated generator output. With the generator equalizer circuit operating properly, the loadmeter readings normally will be within two scale marks of each other. For two-generator operation, normal average dc loadmeter values should be 0.3 to 0.6. At the lower readings (below 0.3), the balance between the two loadmeters should be within three scale marks of each other. With one generator inoperative, the single loadmeter reading will be higher (0.5 to 1.0).

DC Voltmeter.

The dc voltmeter (figure 1-14), on the copilot's inboard instrument panel, normally shows the voltage available at the dc essential bus. When the left or right push-button switch (below the voltmeter) is pressed, the voltmeter shows the voltage of the selected left or right dc generator. The voltmeter should show about 28 volts when engine speeds are above idle rpm.

AC ELECTRICAL POWER DISTRIBUTION.

AC power from the main or stand-by inverter is distributed from the following electrical busses: the 115-volt ac essential bus; 115-volt ac nonessential bus; and, through transformers, two 26-volt ac busses and four 5-volt indirect light busses. The attitude indicator system, inverter voltage test switch, and ac voltmeter receive A-, B-, and C-phase power from either operating inverter. An engine-driven ac generator on each engine provides power only for heating the two forward windshields. (Refer to "Windshield Anti-icing System" in Section IV and see figure 1-15).

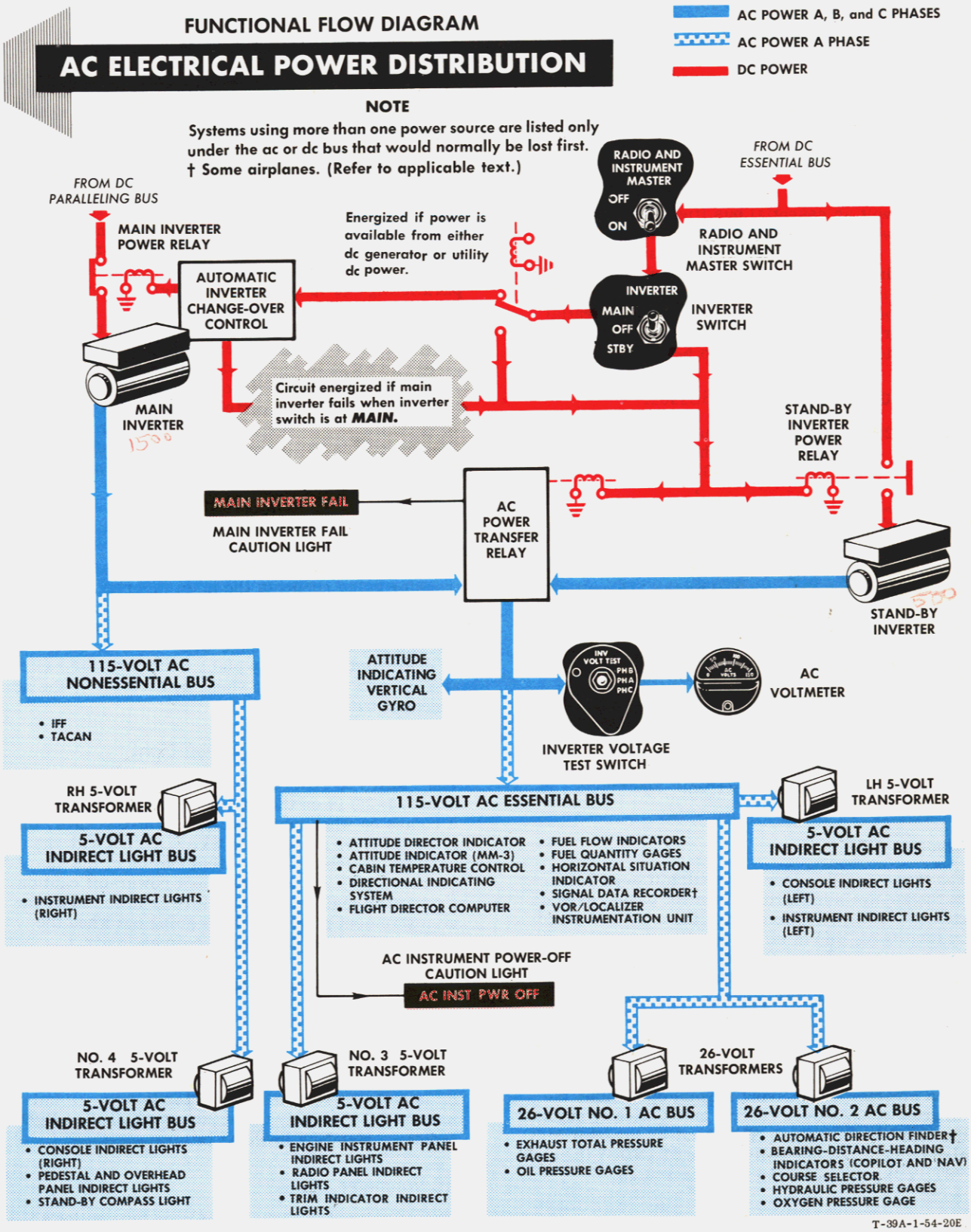

FUNCTIONAL FLOW DIAGRAM
AC ELECTRICAL POWER DISTRIBUTION
AC POWER A, B, and C PHASES
AC POWER A PHASE
DC POWER
NOTE
Systems using more than one power source are listed only under the ac or dc bus that would normally be lost first.
† Some airplanes. (Refer to applicable text.)
FROM DC PARALLELING BUS
MAIN INVERTER POWER RELAY
AUTOMATIC INVERTER CHANGE-OVER CONTROL
Energized if power is available from either dc generator or utility dc power.
RADIO AND INSTRUMENT MASTER
OFF
ON
FROM DC ESSENTIAL BUS
RADIO AND INSTRUMENT MASTER SWITCH
INVERTER
MAIN
OFF
STBY
INVERTER SWITCH
MAIN INVERTER
Circuit energized if main inverter fails when inverter switch is at MAIN.
STAND-BY INVERTER POWER RELAY
MAIN INVERTER FAIL
MAIN INVERTER FAIL CAUTION LIGHT
AC POWER TRANSFER RELAY
STAND-BY INVERTER
115-VOLT AC NONESSENTIAL BUS
• IFF
• TACAN
ATTITUDE INDICATING VERTICAL GYRO
INV VOLT TEST
PH B
PH A
PH C
INVERTER VOLTAGE TEST SWITCH
AC VOLTMETER
RH 5-VOLT TRANSFORMER
5-VOLT AC INDIRECT LIGHT BUS
• INSTRUMENT INDIRECT LIGHTS (RIGHT)
115-VOLT AC ESSENTIAL BUS
• ATTITUDE DIRECTOR INDICATOR
• ATTITUDE INDICATOR (MM-3)
• CABIN TEMPERATURE CONTROL
• DIRECTIONAL INDICATING SYSTEM
• FLIGHT DIRECTOR COMPUTER
• FUEL FLOW INDICATORS
• FUEL QUANTITY GAGES
• HORIZONTAL SITUATION INDICATOR
• SIGNAL DATA RECORDER†
• VOR/LOCALIZER INSTRUMENTATION UNIT
LH 5-VOLT TRANSFORMER
5-VOLT AC INDIRECT LIGHT BUS
• CONSOLE INDIRECT LIGHTS (LEFT)
• INSTRUMENT INDIRECT LIGHTS (LEFT)
AC INSTRUMENT POWER-OFF CAUTION LIGHT
AC INST PWR OFF
NO. 4 5-VOLT TRANSFORMER
5-VOLT AC INDIRECT LIGHT BUS
• CONSOLE INDIRECT LIGHTS (RIGHT)
• PEDESTAL AND OVERHEAD PANEL INDIRECT LIGHTS
• STAND-BY COMPASS LIGHT
NO. 3 5-VOLT TRANSFORMER
5-VOLT AC INDIRECT LIGHT BUS
• ENGINE INSTRUMENT PANEL INDIRECT LIGHTS
• RADIO PANEL INDIRECT LIGHTS
• TRIM INDICATOR INDIRECT LIGHTS
26-VOLT TRANSFORMERS
26-VOLT NO. 1 AC BUS
• EXHAUST TOTAL PRESSURE GAGES
• OIL PRESSURE GAGES
26-VOLT NO. 2 AC BUS
• AUTOMATIC DIRECTION FINDER†
• BEARING-DISTANCE-HEADING INDICATORS (COPILOT AND NAV)
• COURSE SELECTOR
• HYDRAULIC PRESSURE GAGES
• OXYGEN PRESSURE GAGE
T-39A-1-54-20E

Figure 1-15

115-volt AC Nonessential Bus.

The 115-volt ac nonessential bus is powered by A-phase power from the main inverter. The nonessential bus, through two 5-volt step-down transformers, powers two indirect light busses. In case of a main inverter failure, power is lost to these busses.

AC Essential Bus.

The 115-volt ac essential bus (figure 1-15) is normally powered by A-phase power from the main inverter. If the stand-by inverter is turned on or is operating because of a main inverter failure, the ac essential bus becomes powered by A-phase power from the stand-by inverter. AC essential bus power is provided through step-down transformers to two 26-volt and two 5-volt ac busses.

No. 1 and No. 2 26-volt AC Busses.

The two 26-volt ac busses (figure 1-15) are powered by the ac essential bus through two step-down transformers, one for each 26-volt bus.

5-volt AC Indirect Light Busses.

The 5-volt ac indirect light busses (figure 1-15) are powered through step-down transformers. Two 5-volt ac busses are powered by the 115-volt ac nonessential bus, and two are powered by the 115-volt ac essential bus.

Radio and Instrument Master Switch.

The two-position radio and instrument master switch (figure 1-14), on the overhead panel, must be ON for operation of the inverter, as well as for some dc-powered circuits. (Refer to "Communications and Associated Electronic Equipment" in Section IV.)

Inverter Switch.

The three-position inverter switch (figure 1-14), on the copilot's inboard instrument panel, uses dc essential bus power to control the main and stand-by inverters, and is effective when the radio and instrument master switch is ON. For normal operation, the inverter switch should be at MAIN. With the switch in this position, the main inverter is selected and supplies power to all ac busses. The stand-by inverter is held inoperative through a transfer relay when the inverter switch is at MAIN as long as the main inverter is operating. If the main inverter fails during normal operation, the inverter change-over control automatically engages the stand-by inverter. The stand-by inverter may also be selected manually by the STANDBY (labeled "STBY") position of the inverter switch.

NOTE The stand-by inverter supplies power for the attitude indicator system and all ac busses except the 115-volt ac nonessential bus and the two 5-volt ac indirect light transformers which are powered by the 115-volt ac nonessential bus.

Moving the inverter switch to OFF disconnects dc power from the inverter control circuits and shuts down both inverters.

Automatic Inverter Change-over Control.

The automatic inverter change-over control during normal operation (radio and instrument master switch ON, inverter switch MAIN) energizes the main inverter power relay and connects the dc paralleling bus to the main inverter. When the voltage output of the main inverter drops below 90 volts, the automatic inverter change-over control de-energizes the main inverter power relay, energizes and locks in the stand-by inverter power relay, and energizes the ac power transfer relay to connect stand-by inverter power to the 115-volt ac essential bus. The automatic inverter change-over control is bypassed and the ac transfer relay is energized when the inverter switch is manually positioned at STANDBY.

AC Power Transfer Relay.

In the normal unenergized position, the ac power transfer relay connects the main inverter to the ac essential bus. Should the main inverter fail, the ac power transfer relay is automatically energized through the inverter change-over control, or it can be energized directly by placing the inverter switch at STBY, to connect the stand-by inverter to the ac essential bus.

Main Inverter Failure Caution Light.

The "MAIN INVERTER FAIL" amber caution light (figure 1-26) is on the caution-warning light panel. It comes on when main inverter failure occurs, or if the inverter switch is at STANDBY. (With the inverter switch at MAIN, illumination of the inverter failure and ac instrument power-off caution lights upon main inverter failure is followed by the ac instrument power-off light going out when the stand-by inverter is engaged automatically.)

AC Instrument Power-off Caution Light.

The "AC INST PWR OFF" amber caution light (figure 1-26) is on the caution-warning light panel. It comes on when the ac essential bus is not energized. If the stand-by inverter has been turned on, or is on because of main inverter failure, illumination of the ac instrument power-off caution light indicates stand-by inverter failure.

AC Voltmeter.

The ac voltmeter (figure 1-14), on the copilot's inboard instrument panel, shows the voltage of the particular phase of inverter output according to the

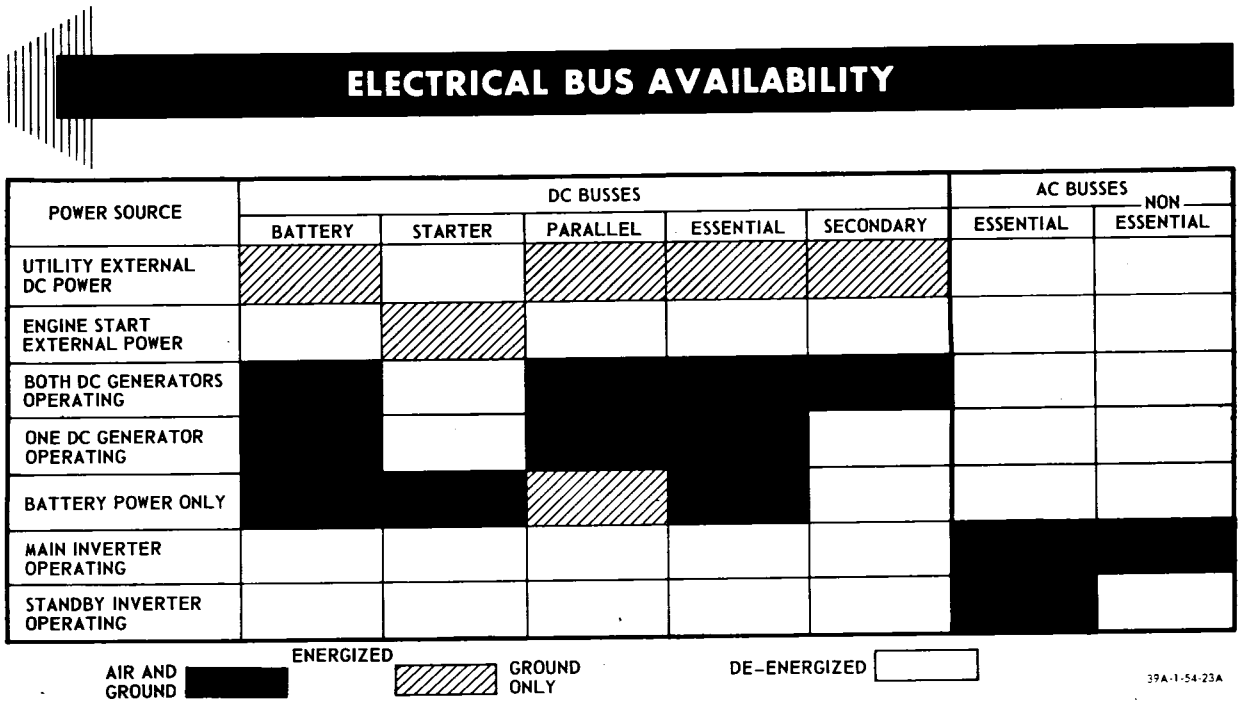


Figure 1-16

selected position of the inverter voltage test switch. (The voltmeter indicates the voltage supplied by either the main or stand-by inverter, whichever is operating.) During normal flight conditions, the A-phase voltage should be 115 (±8) volts for the main inverter and 115 (±6) volts for the stand-by inverter. B- or C-phase voltage readings should be 115 (±15) volts for either inverter.

Inverter Voltage Test Switch.

This three-position switch (figure 1-14), on the copilot's inboard instrument panel, is used to select the phase of ac voltage shown on the ac voltmeter. The switch is spring-loaded to the phase A position, labeled "PHA," which is the phase normally indicated on the ac voltmeter. When the switch is held up in the PHB position, B-phase voltage is indicated. When the switch is held down in the PHC position, C-phase voltage is indicated. All ac-operated equipment utilizes single-phase power (A-phase), except the vertical gyro system, which requires 3-phase power. Therefore, B- and C-phase voltage readings indicate the potential of the respective phase to the vertical gyro system, whereas A-phase voltage readings indicate the system potential.

AC GENERATORS.

AC Generator Switches.

Refer to "Windshield Anti-icing System" in Section IV.

AC Generator-off Caution Lights.

Refer to "Windshield Anti-icing System" in Section IV.

AC Generator Overheat Caution Lights.

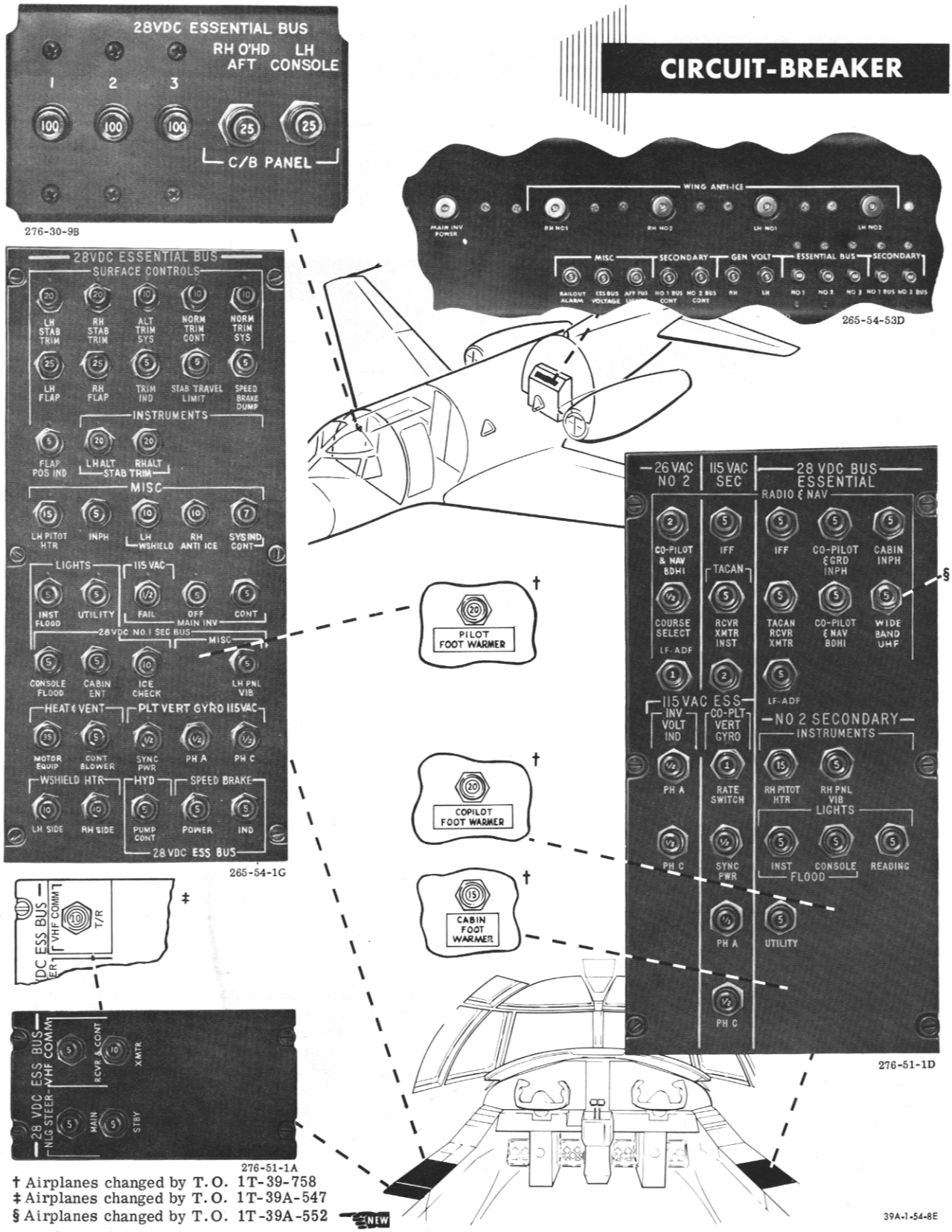
Refer to "Windshield Anti-icing System" in Section IV.

EXTERNAL POWER RECEPTACLES.

The two dc external power receptacles (figure 1-31) are within a single access door on the left side of the fuselage, behind the wing trailing edge. The oval dc utility receptacle permits all dc busses, except the starter bus, to be powered from an external source for system operation and battery charging. There is no switch in the cockpit to control utility external power. The rectangular dc starter receptacle permits an external source to power only the starter bus. When the external power source plug is connected to the starter receptacle, it actuates a switch which prevents the airplane batteries from being connected to the starter bus. There is no ac external power receptacle.

ELECTRICAL BUS AVAILABILITY.

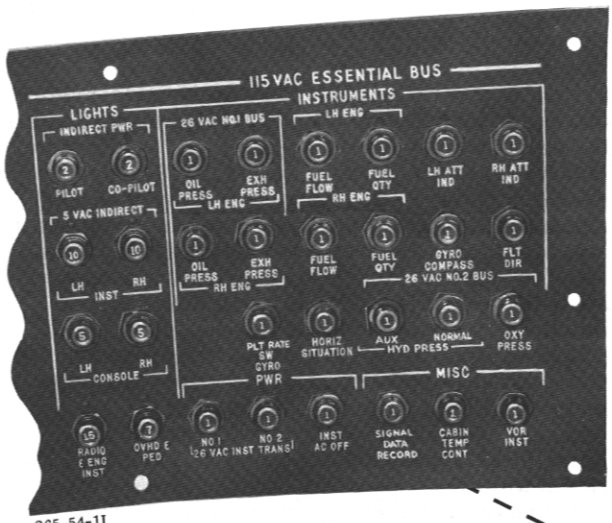
Figure 1-16 shows, in simplified form, the various electrical power sources and the busses each is capable of energizing. The information



† Airplanes changed by T.O. 1T-39-758
‡ Airplanes changed by T.O. 1T-39A-547
§ Airplanes changed by T.O. 1T-39A-552

Figure 1-17

PANELS



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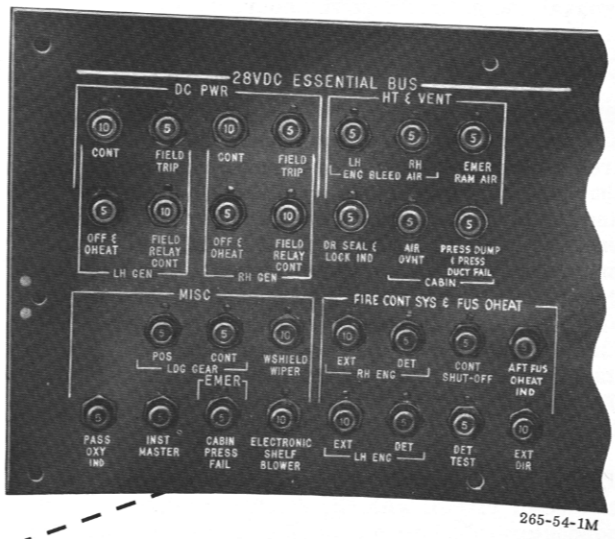

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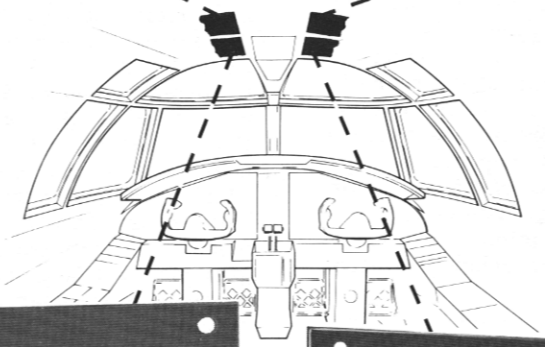

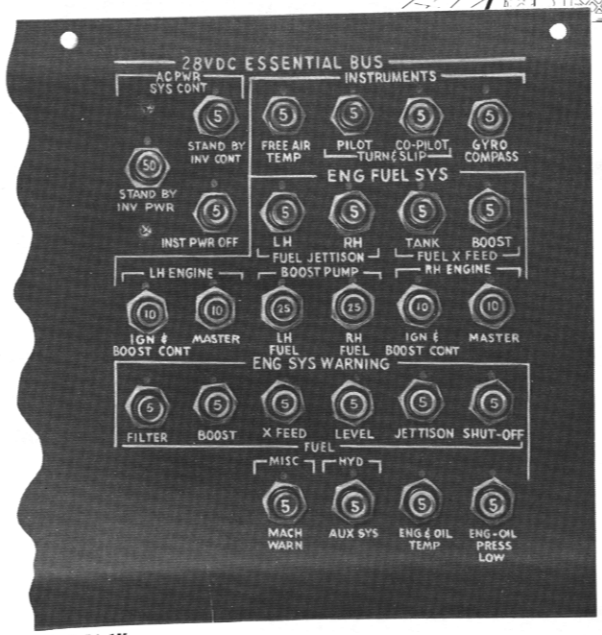

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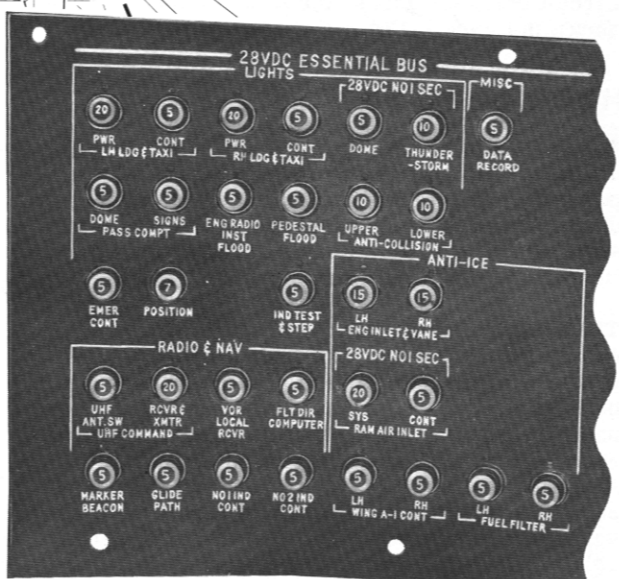

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T-39A-1-54-22

presented is based on the assumption that all affected electrical system switches are in their normal operating positions. Details of automatic and manual switching are not presented; however, the busses affected are shown energized for both normal and alternate power sources.

CIRCUIT BREAKERS.

The dc and ac electrical power distribution circuits are protected by two types of push-to-reset, trip-free circuit breakers: the normal push-pull type that indicate an overload condition when tripped, and the large red circuit breakers (on the circuit-breaker panel at the rear of the cabin) that do not provide any indication when tripped. The large red circuit breakers may be pushed in, and an audible click indicates the rest. If no short-circuit condition exists, both types can be manually reset after a reasonable cooling period. This cooling period will vary with current overload and ambient temperature conditions.

The dc essential bus is protected by a three-conductor circuit with two circuit breakers in each conductor. One circuit breaker for each conductor is on the circuit-breaker panel on the copilot's bulkhead, with the second set of breakers being located on the circuit-breaker panel at the rear of the cabin. If an overload occurs and trips the circuit breakers of one conductor circuit, the remaining two conductors will adequately support the electrical loads on the bus. If two of the conductor circuits are interrupted, the single remaining conductor will marginally support minimum electrical loads on the essential bus for emergency operation.

Circuit breakers accessible to the flight crew are shown in figure 1-17.

HYDRAULIC SYSTEM.

The hydraulic system (figure 1-18) is a 3000 psi utility system powered by a pump that provides power for operation of the landing gear, main gear doors, speed brake, wheel brakes, and nose wheel steering. The system also is actuated in conjunction with the in-flight escape system.

The hydraulic reservoir is pressurized by engine compressor bleed air to provide a positive inlet pressure at the pump and to prevent foaming and boil-off at altitude. Air from the engines is stored under pressure in an air tank and delivered to the reservoir through an air pressure regulator. On some airplanes, † a hydraulic reservoir air pressure gage permits verification of reservoir pressure before pump actuation. On these airplanes, an air filler valve provides a means of depressurizing or pressurizing the reservoir.

The hydraulic reservoir has a filler cap for gravity filling. (See figure 1-31.) An accumulator in the hydraulic system stores hydraulic pressure to supplement pump output during sudden high rates of demand.

HYDRAULIC POWER SYSTEM.

System pressure is provided by an electric-motor-driven hydraulic pump which operates according to the demands made on the system. The pump motor is powered by the paralleling bus, with pump operation controlled by dc essential bus power through a pressure switch. When system pressure is below about 2700 psi, the pressure switch closes to energize the pump motor. The pump continues to operate until system pressure is about 3000 psi. At this time, the switch opens, de-energizing the pump. A time-delay relay is installed which automatically shuts off electrical power to the pump motor if the pump runs continously for over 2 minutes. (This time limit exceeds the maximum operational demands on the pump.) A caution light shows when the time-delay relay interrupts electrical power to the pump, and a switch in the cockpit permits the pump power circuit to be reset. The airplane also has a 3000 psi auxiliary hydraulic accumulator. Auxiliary accumulator pressure is routed to the speed brake, wheel brake, and nose wheel steering systems through separate lines to ensure that failure of either power system does not affect the other. In addition, the auxiliary accumulator will also pressurize the emergency hydraulic power transmitter. (The all-mechanical emergency operation of the landing gear makes it unnecessary to provide auxiliary pressure to the gear.) The auxiliary pressure should be selected and used only when required and provides sufficient fluid and pressure to complete a landing if the normal hydraulic system fails. (See figure 1-18.)

NOTE A check of normal operation of the hydraulic pump can be made with both the normal and auxiliary accumulators fully charged, the auxiliary hydraulic power switch at OFF, and no hydraulic demand on the system. During such conditions, the pump should not operate more often than once every 4 minutes and should build up to a full 3000 psi smoothly and promptly during each cycle. (An increase in the dc loadmeter reading shows when the pump is operating.) If pump operation exceeds the specified cycle, excessive internal leakage or bypass of the hydraulic system is indicated, and the system should be checked out.

HYDRAULIC PUMP SWITCH.

The two-position hydraulic pump switch (10, figure 1-6), on the overhead panel, controls paralleling bus power to the hydraulic pump motor by means of

†Airplanes changed by T.O. 1T-39A-548

dc essential bus power. When the switch is ON, the pump motor is cycled on and off automatically by a pressure switch in response to the demands of the hydraulic system. The pump circuit is inoperative when the switch is at OFF & RESET. If the pump runs continuously for an excessive period (over 2 minutes), a time-delay relay will shut off the pump motor. To restore electrical power to the pump, the circuit can be reset by moving the pump switch momentarily to OFF & RESET and then to ON. (Refer to "Hydraulic Power System Failure" in Section III for pump power reset procedure.)

AUXILIARY HYDRAULIC POWER SWITCH.

Hydraulic power from the auxiliary accumulator is selected by a two-position switch (10, figure 1-6), on the overhead panel. When the switch is at its normally selected OFF position, the auxiliary (spring-loaded open) shutoff valve is closed. If the normal hydraulic power system fails and the normal system is depleted, the switch should be moved to ON only when hydraulic pressure is required. This opens the auxiliary shutoff valve to direct auxiliary accumulator pressure to the speed brake, wheel brake, and nose wheel steering system, and emergency hydraulic power transmitter. The switch should be retruned to OFF whenever possible to conserve auxiliary accumulator power. The auxiliary hydraulic switch is powered by the dc essential bus. Auxiliary accumulator pressure is automatically provided when the dc essential bus is de-energized.

HYDRAULIC PRESSURE GAGES.

The hydraulic pressure gages (49, figure 1-2), on the center instrument panel, are powered by the No. 2 26-volt ac bus. In addition to the normal system pressure gage (labeled "NOR"), an auxiliary system gage (labeled "AUX") is installed which shows the auxiliary hydraulic pressure. The gages are calibrated, in 500 psi increments, from 0 to 4000 psi.

HYDRAULIC PRESSURE/POWER OFF CAUTION LIGHT.

The "HYD PRESS/PWR OFF" amber caution light (figure 1-26) and the master caution light will illuminate if, for any reason, electrical power is removed from the pump switching circuits. The light will also illuminate when system pressure decreases to 1900 (±100) psi. When pressure increases to 2600 (±100) psi, the light will go off. The master caution light is not illuminated under this condition.

FLIGHT CONTROL SYSTEM.

The flight control surfaces (ailerons, rudder, and elevators) are mechanically operated from a conventional set of dual controls. A spring-type bias bungee is incorporated to establish a no-load center position for the controls by interconnecting the elevators and horizontal stabilizers. This no-load position varies automatically with stabilizer position and improves the apparent longitudinal stability. Trim for longitudinal, lateral, and directional control is accomplished by electromechanical actuators that position the trim tabs on the rudder and left aileron and reposition the horizontal stabilizer for longitudinal trim. Two actuators, mechanically interconnected, are used to actuate the horizontal stabilizer. Horizontal stabilizer trim is accomplished for two conditions. When the landing gear is retracted, trimming is accomplished at a low-speed rate; with the gear extended, trimming rate is high. When the landing gear is retracted, the horizontal stabilizer trim range is 1.0 to 6.0 degrees (horizontal stabilizer leading edge down); when the gear is extended, the trim range is 1.0 to 9.0 degrees. Refer to Section V for horizontal stabilizer trim setting restrictions. A test switch is installed to check the automatic 6-degree trim cutoff feature while on the ground. Two complete and independent trim control electrical circuits, a normal and an alternate circuit, are provided. A trim emergency disconnect circuit is provided to interrupt the normal trim circuit in case of runaway trim or a sticking trim switch. A separate trim position indicator is provided for each trim system.

A bobweight is installed for obtaining a positive stick force of 10 pounds per G of normal acceleration, and a bobweight balance bungee is used to statically balance the system at a positive 1 G. A mechanical flight control gust lock is provided which interconnects with the throttle mechanism. When the gust lock is engaged, the throttle movement is restricted, so only limited thrust is available.

CONTROL WHEELS.

The pilot's and copilot's control wheels (figure 1-20) are identical except that incorporated switches are in reverse locations. The nose wheel steering, interphone-microphone, and trim switches are on the outboard grip of each wheel. A trim emergency disconnect switch is on the inboard grip of each wheel. The interphone-microphone switch is installed on the forward face of each outboard grip.

RUDDER PEDALS.

A set of rudder pedals is provided for the pilot and copilot. The rudder pedals control the rudder action through direct mechanical linkage to the rudder. The wheel brakes are actuated by pressure on the top of the rudder pedals. The rudder pedals may be adjusted for correct leg length.

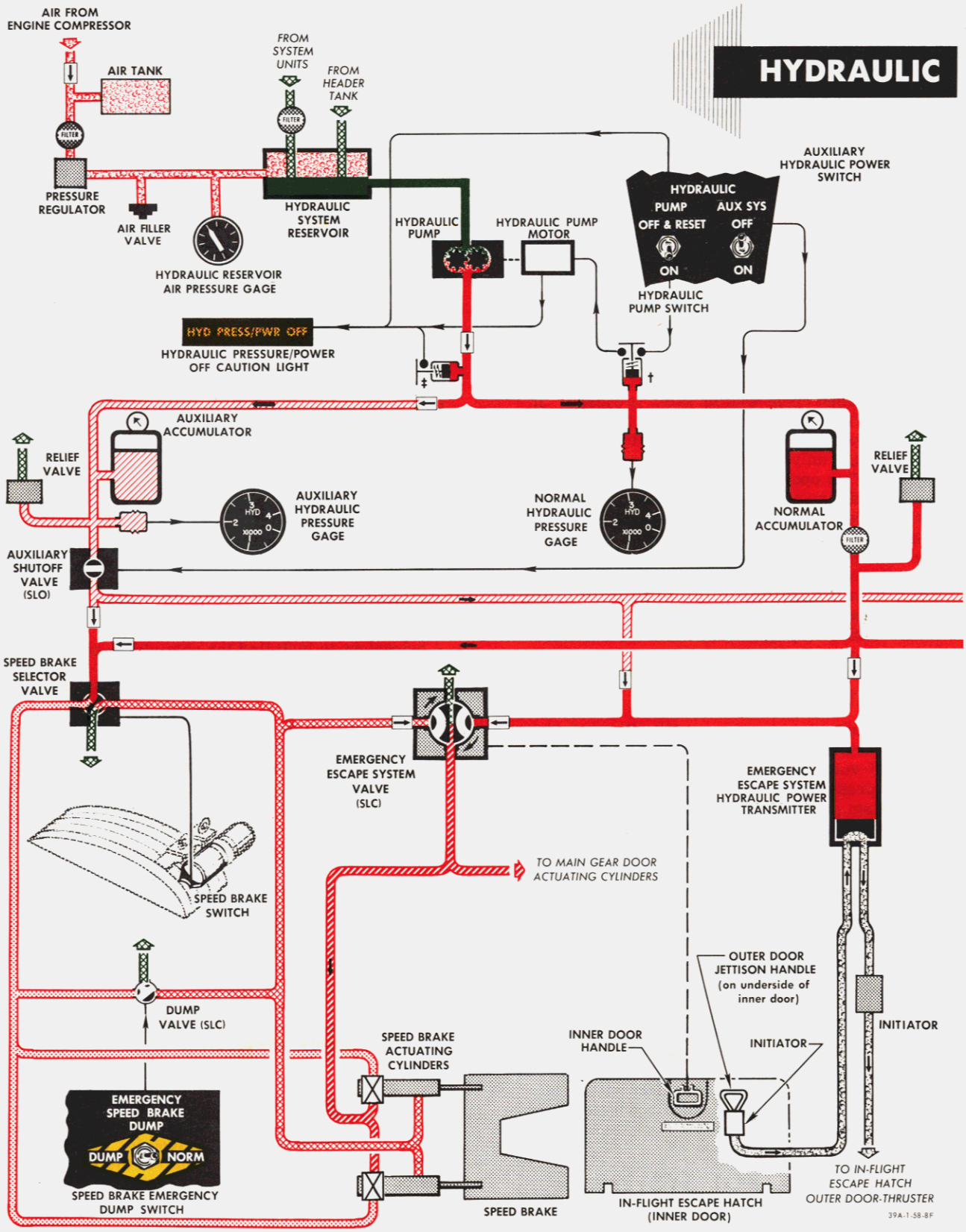

HYDRAULIC
AIR FROM ENGINE COMPRESSOR
AIR TANK
FROM SYSTEM UNITS
FROM HEADER TANK
FILTER
PRESSURE REGULATOR
AIR FILLER VALVE
HYDRAULIC SYSTEM RESERVOIR
HYDRAULIC RESERVOIR AIR PRESSURE GAGE
HYDRAULIC PUMP
HYDRAULIC PUMP MOTOR
AUXILIARY HYDRAULIC POWER SWITCH
HYDRAULIC PUMP OFF & RESET ON
AUX SYS OFF ON
HYDRAULIC PUMP SWITCH
HYD PRESS/PWR OFF
HYDRAULIC PRESSURE/POWER OFF CAUTION LIGHT
AUXILIARY ACCUMULATOR
RELIEF VALVE
AUXILIARY HYDRAULIC PRESSURE GAGE
NORMAL HYDRAULIC PRESSURE GAGE
NORMAL ACCUMULATOR
RELIEF VALVE
AUXILIARY SHUTOFF VALVE (SLO)
SPEED BRAKE SELECTOR VALVE
EMERGENCY ESCAPE SYSTEM VALVE (SLC)
EMERGENCY ESCAPE SYSTEM HYDRAULIC POWER TRANSMITTER
TO MAIN GEAR DOOR ACTUATING CYLINDERS
SPEED BRAKE SWITCH
OUTER DOOR JETTISON HANDLE (on underside of inner door)
INITIATOR
DUMP VALVE (SLC)
SPEED BRAKE ACTUATING CYLINDERS
INNER DOOR HANDLE
INITIATOR
EMERGENCY SPEED BRAKE DUMP
DUMP NORM
SPEED BRAKE EMERGENCY DUMP SWITCH
SPEED BRAKE
IN-FLIGHT ESCAPE HATCH (INNER DOOR)
TO IN-FLIGHT ESCAPE HATCH OUTER DOOR-THRUSTER
39A-1-58-8F

Figure 1-18

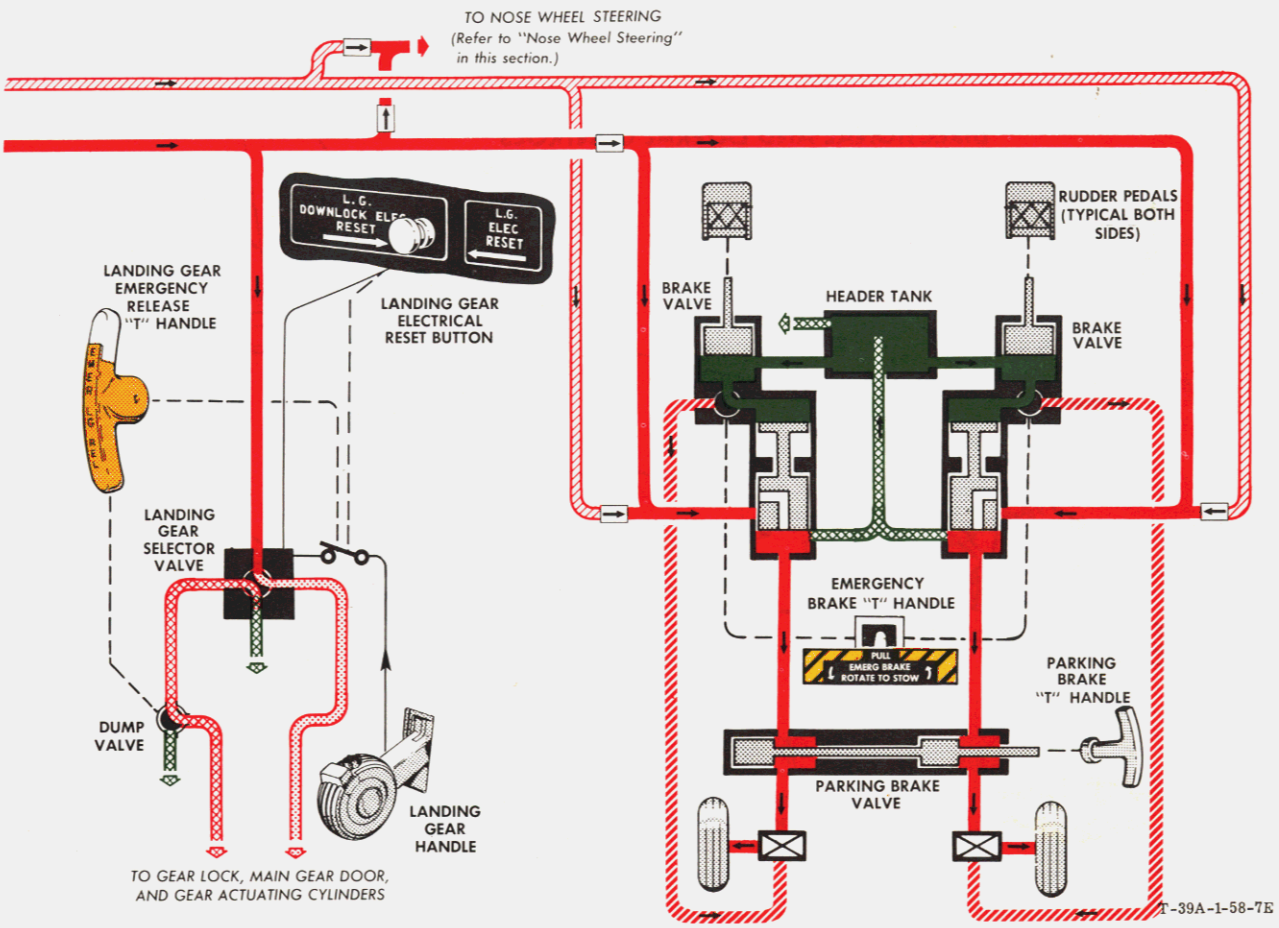
SYSTEM

PRESSURE
ENGINE COMPRESSOR AIR
AUXILIARY PRESSURE
SUPPLY
RETURN
DOWN
UP
EMERGENCY PRESSURE
GAS LINE

ELECTRICAL CONNECTION
MECHANICAL LINKAGE
PRESSURE SWITCH
SHUTTLE VALVE
PRESSURE TRANSMITTER
CHECK VALVE
SLO SPRING-LOADED OPEN
SLC SPRING-LOADED CLOSED

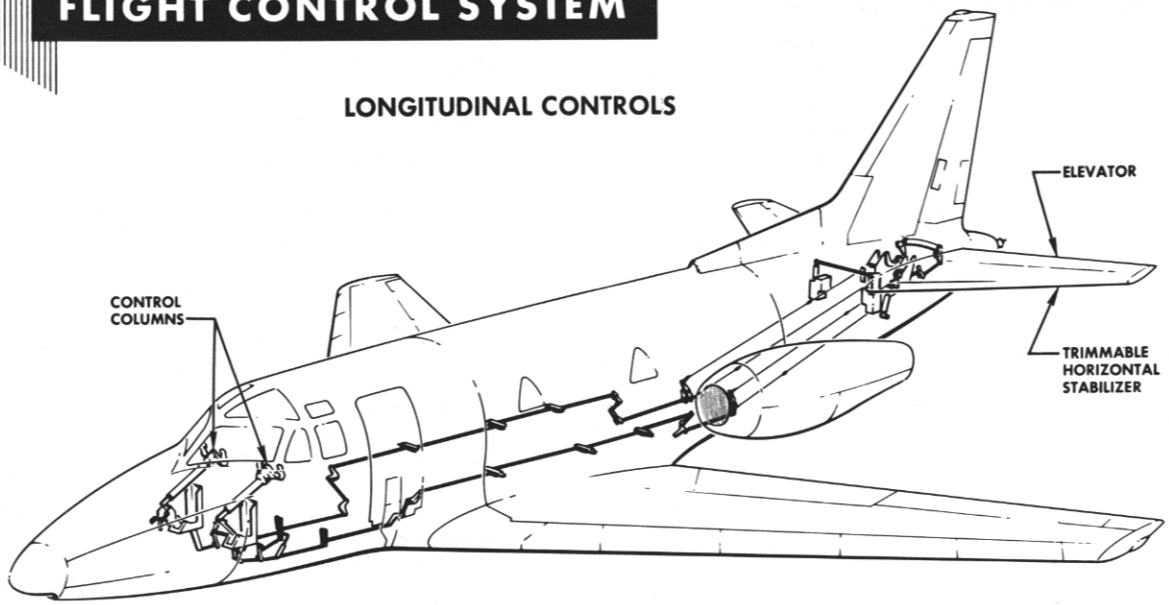
† Closes when pressure is below about 2700 psi. Opens when pressure is about 3000 psi.

‡ Closes when pressure is below about 1900 psi. Opens when pressure is about 2600 psi.

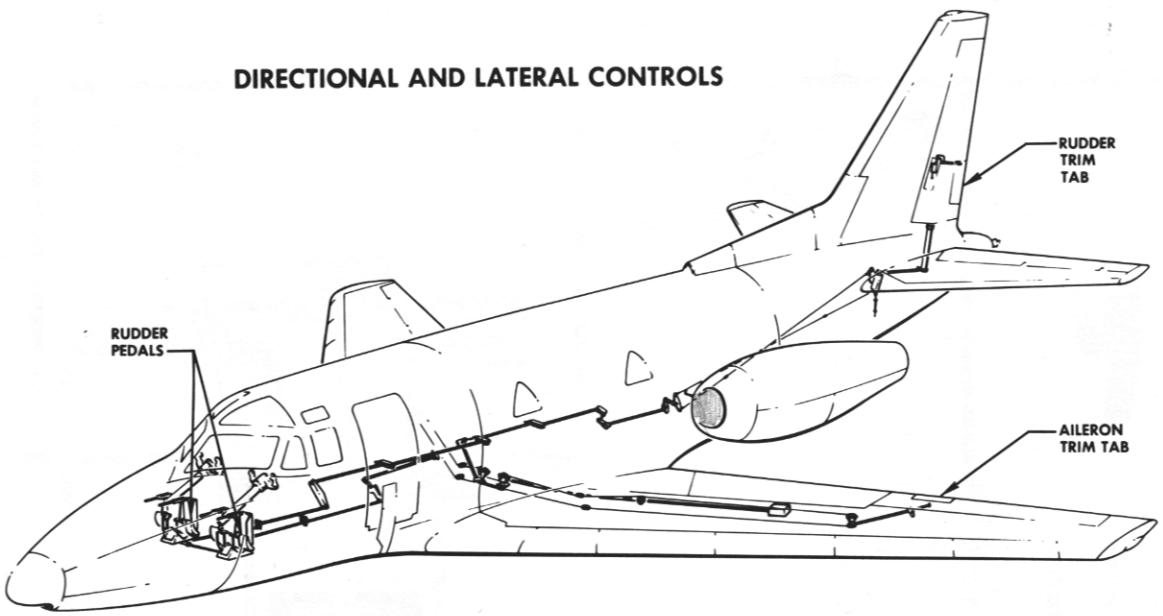


FLIGHT CONTROL SYSTEM

LONGITUDINAL CONTROLS



DIRECTIONAL AND LATERAL CONTROLS



NOTE

The control surfaces are mechanically controlled and the trim controls are electrically operated.

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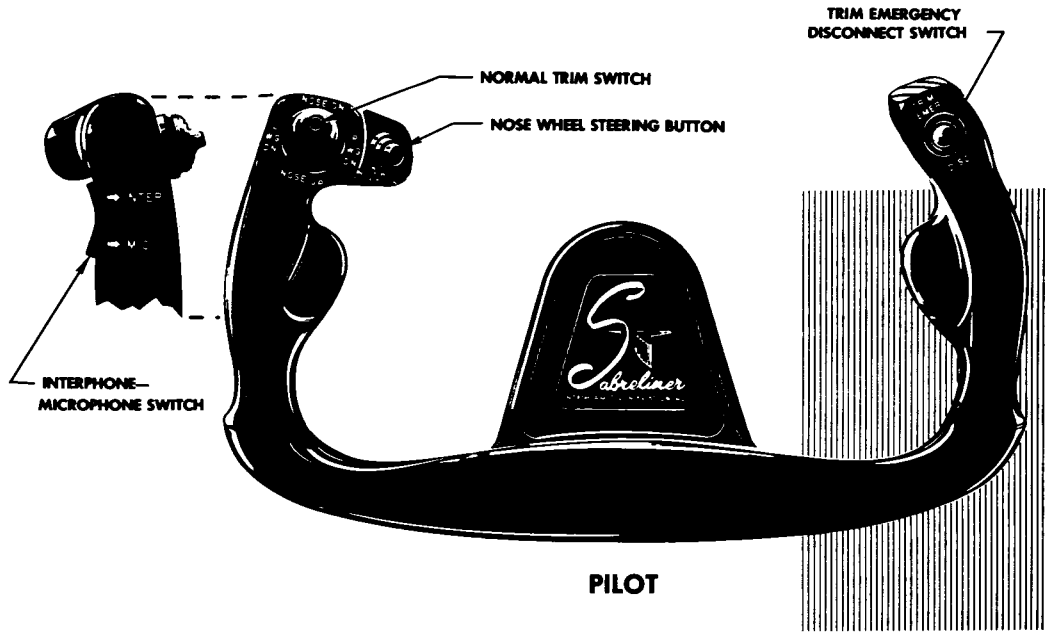
Figure 1-19

CONTROL WHEELS



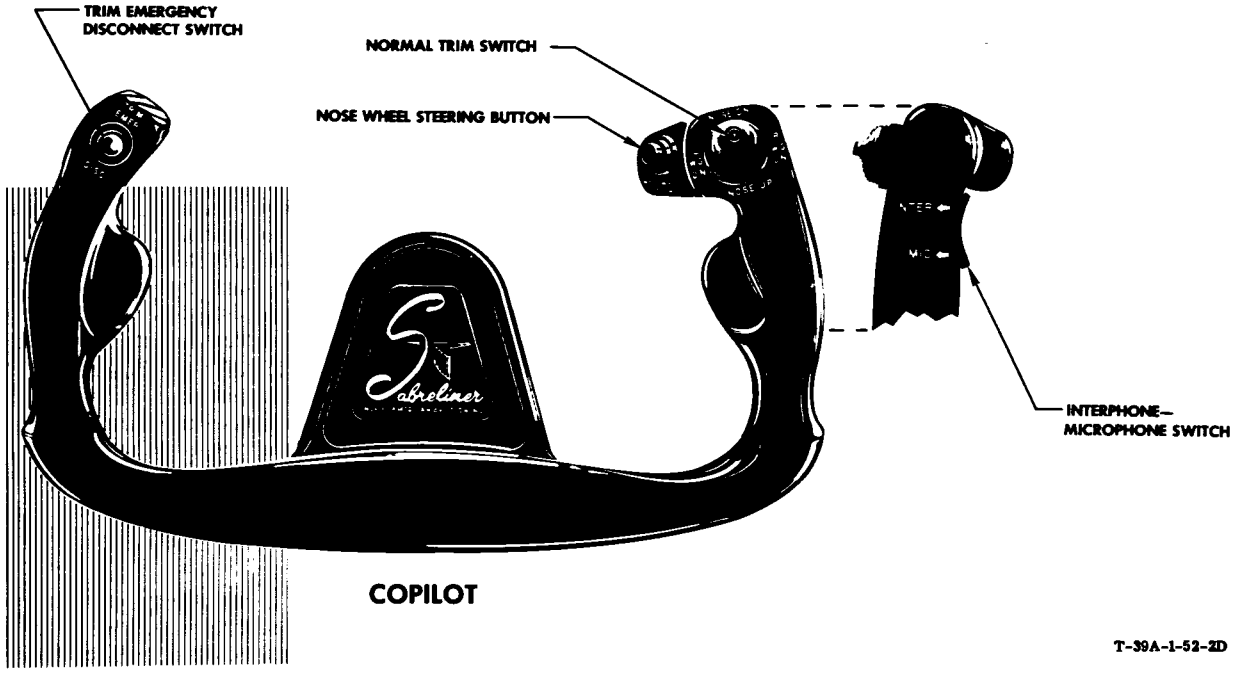


Figure 1-20

RUDDER PEDAL ADJUSTMENT KNOB.

Comfortable leg-length adjustment of the rudder pedals may be accomplished by a rudder pedal adjustment knob (43 and 58, figure 1-2), on the control pedestal directly below the control wheels. Turning the knob counterclockwise adjusts the pedals aft (toward the pilot); clockwise turning adjusts the pedals forward.

GUST LOCK "T" HANDLE.

The push-pull gust lock "T" handle (59, figure 1-2) is below the control wheel on the pilot's side only. To apply the gust lock, the handle is moved out of the detent and aft to the ENGAGED position, while the throttles are at IDLE or below. Movement of the control systems through neutral engages the control lock. The throttles are also blocked so that only limited thrust is available. To release the gust lock, the handle is moved out of the detent and pushed to the full forward STOWED position.

NOTE Engine starting may be performed without releasing the gust lock. This may be desirable during windy or gusty weather operations; however, nose wheel steering is not available, since the rudder pedals are locked.

TRIM CONTROL SELECTOR SWITCH.

A positive-lock trim control selector switch (figure 1-21), on the alternate trim control panel, is powered by the dc essential bus. The switch has three positions: NORMAL, ALTERNATE, and OFF. When the switch is in the NORMAL position, elevator and aileron trim are controlled by the normal trim switch on the control wheel, and rudder trim is controlled by the normal rudder trim switch on the center pedestal. With the trim selector switch in the ALTERNATE position, all trim is controlled by the alternate trim switches (figure 1-21), on the alternate trim control panel. With the switch in OFF position, both trim systems are inoperative.

NORMAL TRIM SWITCH.

Normal trim of the horizontal stabilizer or of the aileron tab is provided through a five-position switch (figure 1-20), on the aft face of each control wheel outboard grip. Trim is effected by setting the wheel for the desired flight attitude and then operating the normal trim switch to remove the load (control forces) from the wheel. Switch positions are LEFT WING DOWN, NOSE DOWN, RIGHT WING DOWN, and NOSE UP (labeled "L WG DN," "NOSE DN," "R WG DN," and "NOSE UP"). When the switch is released, it automatically returns to the OFF (center) position and trim action stops. A slight amount of movement of the wheel and rudder pedals may be noticed when corresponding trim is applied.

RUDDER TRIM SWITCH.

Normal trim of the rudder is provided through a three-position switch (5, figure 1-5) on the center pedestal below the throttles. Holding the rudder trim switch to R (right) trims the nose of the airplane to the right; holding it to L (left) trims the nose left. When the switch is released, it automatically returns to the OFF (center) position and trim action stops. The normal trim switches are powered by the dc essential bus.

TRIM EMERGENCY DISCONNECT SWITCH.

A trim emergency disconnect switch (figure 1-20) is installed on the aft face of the control wheel to be used in case of a defective normal trim switch. If the normal trim switch sticks or a runaway trim condition occurs, depressing the disconnect switch stops all trim action. The trim emergency disconnect switch is operative only when the normal trim system is operative and must be held depressed until the trim selector switch can be positioned to OFF. All additional trim during the flight must be accomplished with the alternate trim system.

NOTE The alternate trim system is not protected by the trim disconnect switch.

HORIZONTAL STABILIZER TRIM LIMIT TEST SWITCH.

The horizontal stabilizer trim limit test switch (61, figure 1-2) is on the forward instrument subpanel, just left of the pilot's control column. The switch has three positions: LEFTHAND, RIGHTHAND (labeled "LH" and "RH"), and an unmarked OFF (center) position. It is used for testing the automatic shutoff feature of the trim actuators when the 6-degree position of the stabilizer actuators is reached. A gear-up condition is simulated when the LEFTHAND or RIGHTHAND position is selected and the horizontal stabilizer trim is then actuated toward the leading-edge-down setting. The trim should stop at the 6-degree setting when the switch is held in the LEFTHAND or RIGHTHAND position. If the trim does not shut off at this point, a faulty circuit is indicated and should be remedied before flight. The switch is powered by the dc essential bus and is for ground-test purposes only.

ALTERNATE TRIM SWITCHES.

An alternate trim system is provided to be used in case of a normal trim system failure. When the trim control selector switch (figure 1-21) is positioned at ALTERNATE, the ailerons and horizontal stabilizer are trimmed through the five-position

ALTERNATE TRIM CONTROL PANEL

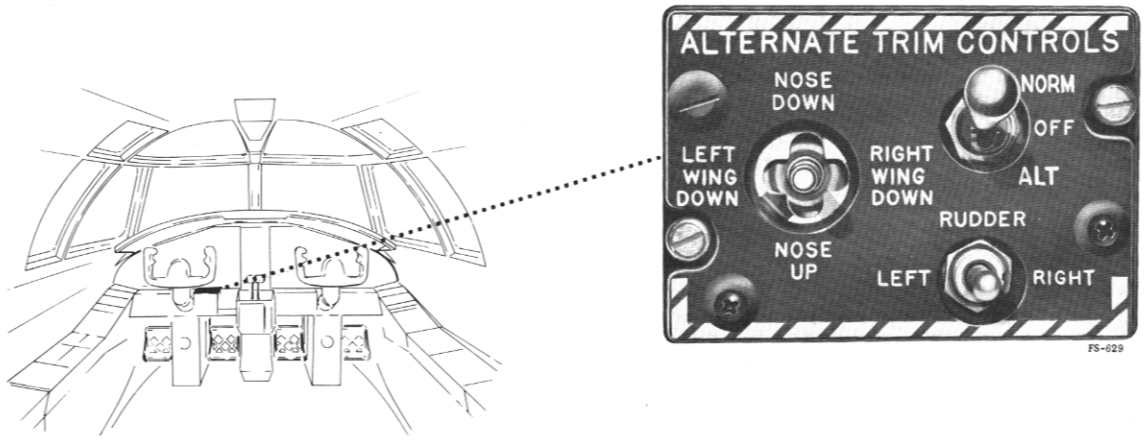


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Figure 1-21

switch (figure 1-21) on the alternate trim control panel. Holding the alternate trim switch to either LEFT WING DOWN or RIGHT WING DOWN causes the corresponding wing to be trimmed down. Holding the alternate trim switch forward to NOSE DOWN trims the airplane nose down; holding it aft to NOSE UP trims the nose up. When the switch is released, it automatically returns to the OFF (center) position and trim action stops. The alternate system trims the horizontal stabilizer at the low-speed rate.

Caution Do not exceed 6 degrees of trim when the airspeed is above 180 knots, since the alternate trim bypasses the limit switch and will trim through the full range to 9 degrees.

Alternate trim of the rudder is provided through a three-position switch (figure 1-21) on the alternate trim control panel. Holding the trim switch at RIGHT trims the nose of the airplane to the right; holding it at LEFT trims the nose left. When the switch is released, it automatically returns to the OFF (center) position and trim action stops. The alternate trim switches are powered by the dc essential bus.

TRIM POSITION INDICATORS.

There are three trim position indicators, on the copilot's inboard instrument panel, powered by the dc essential bus. The horizontal stabilizer trim position indicator (24, figure 1-2) indicates the airplane nose-up trim condition in terms of horizontal stabilizer leading edge trim position. The rudder trim tab position indicator (25, figure 1-2) is calibrated 15 degrees right or left in increments of 5 degrees. The aileron trim tab position indicator (26, figure 1-2) is calibrated 12 degrees wing up or wing down in increments of 4 degrees.

WING SLATS.

Wing slats (4, figure 1-1) extend along the leading edge of each wing panel. Aerodynamic forces acting upon the slats cause the slats to open and close automatically as a function of angle of attack. When they open, the slats move forward along a curved track, forming a slot in the wing leading edge. This automatic extension of slats smooths the airflow over the upper surface of the wing and allows the wing to go to higher angles of attack before stalling, resulting in lower stalling speeds. At higher speed, in unaccelerated flight, the slats automatically close to provide minimum drag for maximum performance in flight.

WING FLAP SYSTEM.

Electrically operated, slotted-type wing flaps (7, figure 1-1) extend from the aileron to within approximately 2 feet of the fuselage on each wing

panel. Each flap is operated by an individual electrical actuator through an individual electric circuit. The actuators are mechanically interconnected by a flexible shaft to synchronize the flap travel. Each actuator is capable of driving the opposite flap through the synchronizing shaft along with the flap to which it is attached. Therefore, in case of a power or motor failure to one actuator, flap positioning (at a reduced speed) is still obtainable. The actuators are of the screw-jack type, and are mechanically irreversible, thus preventing air loads from moving the flaps. No emergency system is provided, as there is enough protection present in the normal system through the mechanical interconnection, individual electric motors, and individual electric circuits.

WING FLAP HANDLE.

The wing flap handle (15, figure 1-5) is recessed in the center pedestal to prevent inadvertent operation. The flap handle, powered by the dc essential bus, moves in a quadrant market "UP," "HOLD," and "DOWN" (labeled "DN"). To position the flaps full up or full down, the flap handle is moved to the corresponding position and left there. (Power is automatically removed from the actuators when the flaps reach the extreme position.) The flaps will extend to the full-down position in 10 to 15 seconds during flight and will retract in 5 to 10 seconds. Intermediate flap positions may be selected by monitoring the flap position indicator during flap operation and placing the flap handle at HOLD when the desired flap position is reached.

WING FLAP POSITION INDICATOR.

A flap position indicator (48, figure 1-2), on the bottom of the center instrument panel, is powered by the dc essential bus. The instrument is calibrated in percent of flap extended and reads from "UP" to "DOWN" in increments of 10 percent. Full flap travel is 25 degrees (100 percent).

SPEED BRAKE SYSTEM.

A hydraulically operated, electrically actuated speed brake is on the lower surface of the fuselage, aft of the nose gear well. The speed brake panel is hinged at its leading edge and, when open, extends down and forward to increase drag. The speed brake may be operated at any airspeed by a switch on the left throttle. To facilitate bail-out, the speed brake is also extended automatically whenever the in-flight escape system is actuated. (Refer to "Emergency Escape Hatches" in this section.)

SPEED BRAKE MAINTENANCE SAFETY LOCKS AND RED STREAMERS.

For maintenance purposes, two removable safety locks may be installed to keep the speed brake in the extended position when the airplane is on the ground. (See figure 1-22.) A lock assembly is inserted on each of the two speed brake actuating cylinders. The lock assemblies, which have conventional red warning streamers, must be removed before flight.

SPEED BRAKE SWITCH.

A speed brake switch (figure 1-9), on the left side of the left throttle grip, controls speed brake operation. Moving the switch aft to OUT opens the speed brake; moving the switch forward to IN closes it. The switch supplies dc essential bus power to a control valve that directs hydraulic system pressure to the speed brake actuating cylinders. When the switch is returned to the OFF (center) position, the control valve is closed (trapping cylinder pressure) and the brake is held in any desired position. After the brake has been retracted, the switch should be left in the forward IN position to prevent the speed brake from creeping open in flight.

SPEED BRAKE EMERGENCY DUMP SWITCH.

The two-position emergency dump switch (60, figure 1-2), on the pilot's instrument panel, permits the speed brake to be retracted in flight, if hydraulic pressure fails. The speed brake switch must be placed at OFF (center) before the speed brake dump valve will operate. When the dump switch is moved to DUMP, dc essential bus power opens a dump valve which relieves hydraulic pressure from the speed brake actuating cylinders. Air loads then force the speed brake to a trail position. The switch is spring-loaded to NORMAL (labeled "NORM"). Releasing the switch to NORMAL allows the dump valve to close, trapping hydraulic fluid in the actuating cylinder to hold the speed brake in the trail position. The dump valve is reset for normal operation of the speed brake system when the emergency dump switch is returned to NORMAL.

SPEED BRAKE CAUTION LIGHT.

The "SPEED BRAKE OPEN" amber caution light (figure 1-26) is on the caution-warning light panel. This light comes on when the speed brake is not closed and if either throttle is at a setting of approximately 95 percent rpm or greater. The light goes out when the speed brake is closed or when both throttles are retarded below 95 percent power. The function of the light is to alert the pilot if the speed brake is not closed during take-offs and go-arounds.

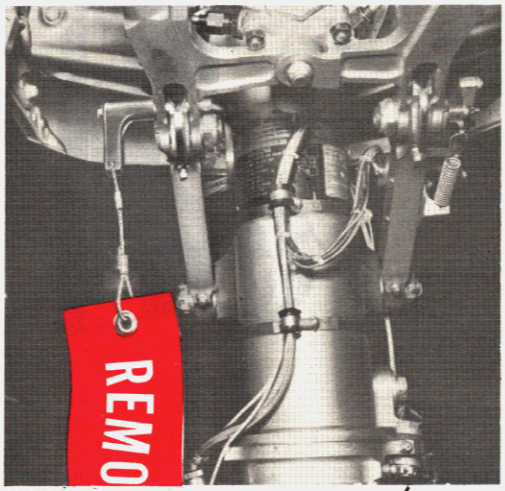
LANDING GEAR SYSTEM.

The fully retractable tricycle landing gear is electrically actuated and hydraulically operated. The nose gear doors are mechanically controlled by the operation of the nose gear. The main landing gear wheel well cover doors are mechanically sequenced and hydraulically actuated. The main gear retracts

MAINTENANCE AND GROUND SAFETY LOCKS

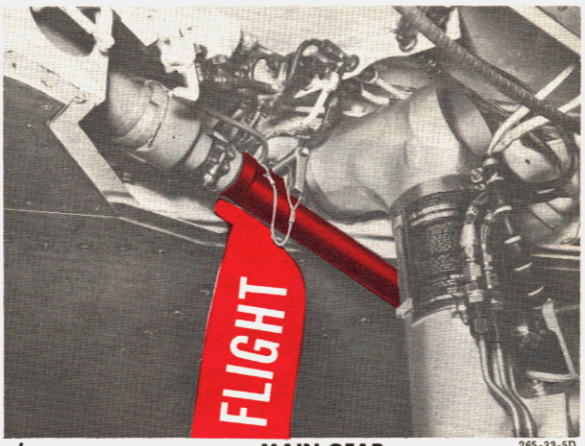
NOTE

There is only one ground safety lock, for the nose gear. All the other safety locks shown are maintenance safety locks.



265-33-5E

NOSE GEAR



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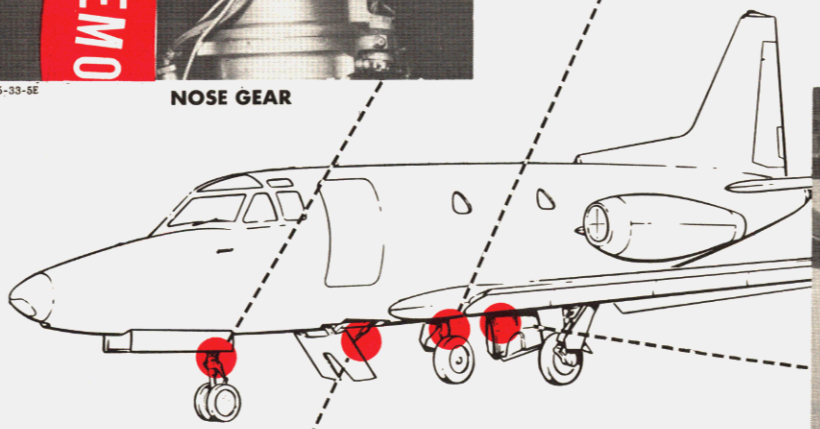
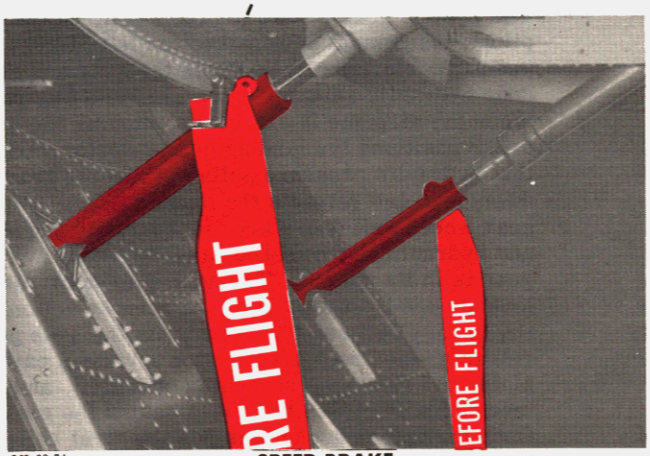
MAIN GEAR
TYPICAL BOTH SIDES)



MAIN GEAR DOORS
(TYPICAL BOTH SIDES)

265-33-6B



265-33-7A

SPEED BRAKE

WARNING

- Make sure all maintenance and ground safety locks are removed before flight.
- If any maintenance safety lock is installed, do not remove it until checking status of the system with maintenance personnel.
- NEW The left and right main gear safety locks are not interchangeable.
- NEW Installation of the maintenance safety locks will not ensure a safe gear condition.

39A-1-73-12D

Figure 1-22

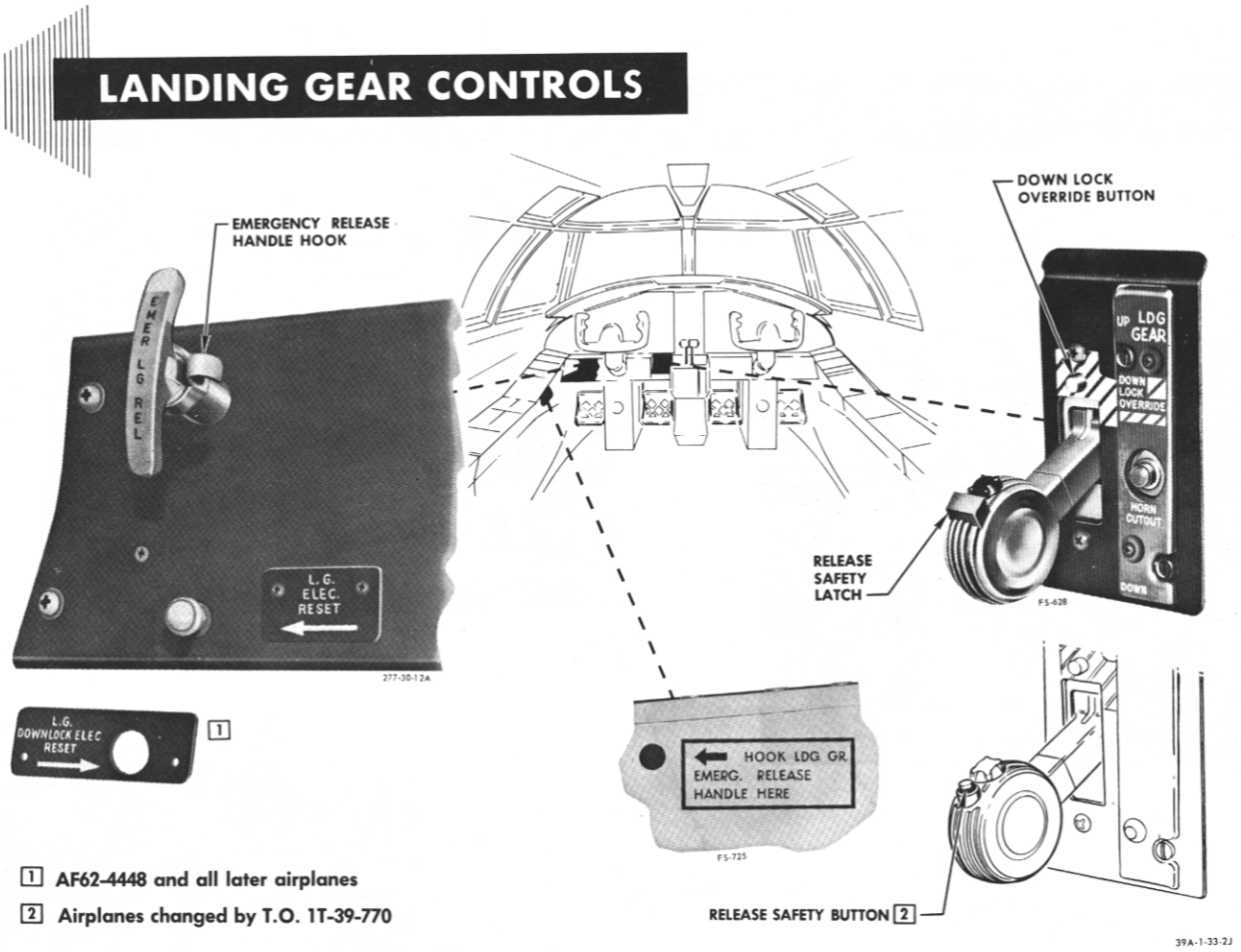


Figure 1-23

inward into the lower surface of the wing; the dual-wheel nose gear retracts forward into the fuselage. The wheel well doors, which fair the gear flush with the airplane contour when the gear is retracted, remain open when the gear is extended. However, in case bail-out is necessary, opening the in-flight escape hatch (inner door) automatically closes the main gear doors (if open) and opens the speed brake if hydraulic pressure is available. If the in-flight emergency escape system has been actuated and the landing gear is retracted, the in-flight escape hatch (inner door) must be closed before the landing gear can be lowered. A safety lock prevents normal landing gear handle operation while the airplane is on the ground. This lock can be overridden if necessary. An emergency means of lowering the gear, in case of hydraulic or electrical failure, is provided. Nose wheel steering is accomplished by a nose wheel steering cylinder attached to the aft side of the nose gear strut. Nose wheel shimmy is eliminated by corotation of the dual nose wheels. The main wheels are equipped with hydraulically operated, dual-disk type brakes.

LANDING GEAR HANDLE.

The landing gear handle (figure 1-23), on the pilot's instrument subpanel to the left of the center pedestal, electrically controls the gear and gear door hydraulic selector by dc essential bus power. When the airplane is air-borne, moving the handle to UP positions the landing gear selector valve so that hydraulic pressure pulls the landing gear downlocks and retracts the landing gear. The main gear wheel well doors are mechanically sequenced and hydraulically powered to close when each main gear is in its uplock. The nose gear doors are locked open by means of an overcenter action of the linkage between the doors. As the nose gear retracts, the shock strut piston strikes a cam plate, to break the overcenter condition, and mechanically closes the doors behind the gear. Once the uplock hooks close on the strut rollers and the wheel doors are closed, the hydraulic pressure in the landing gear system is de-energized and the uplock hooks are held in place by means of an overcenter linkage and spring.

Caution When the weight of the airplane is on the main gear, a solenoid-operated mechanical lock prevents the landing gear handle from being moved to UP. The handle can be placed at UP by pressing the downlock override button. When the gear handle is at UP and with hydraulic and electrical power on the airplane, the landing gear will retract on the ground.

The landing gear handle incorporates a release safety latch or button. On some airplanes, † the rectangular-shaped latch controls a mechanical lock that, when engaged, maintains the landing gear handle in the UP position and prevents inadvertent movement of the handle by accidental bumping. The latch must be pressed when the handle is UP to retract the lock and permit movement of the handle to the DOWN position. On other airplanes, ‡ the gear handle incorporates a push-button type switch that is used to control the solenoid-operated lock. The button must be pressed when the handle is UP to retract the lock and permit movement of the handle to the DOWN position. For both types of landing gear handles, the latch or button must be pressed before the handle is moved from the UP position and held depressed until the handle is full down. This is necessary to prevent damaging or breaking the handle and to prevent unnecessary wear on the latching or locking mechanisms. The latch or button need not be pressed when the landing gear handle is moved to UP after take-off. When the handle is moved to DOWN, the hydraulic selector valve is energized to route hydraulic pressure to the gear-down side of the main gear door cylinders. These cylinders release the main gear door uplock hooks and put the doors down. The landing gear uplock hooks are hydraulically released, and the landing gear cylinders extend the landing gear. When the gear is down, spring-loaded downlocks slide into place and lock the gear down. When all three gears are down and locked, hydraulic pressure is maintained on the down side of the landing gear cylinders, as a safety factor to prevent gear collapse in case the gear downlock pin fails. When the weight of the airplane is on the landing gear, the landing gear handle is mechanically locked in the DOWN position. If it is necessary to retract the landing gear while the weight of the airplane is on the gear, the override push button must be pressed before the landing gear handle can be moved to UP. If the handle is moved to UP with the weight of the airplane on the gear and electrical and hydraulic power is available, the gear downlocks are retracted and hydraulic pressure is applied to the up side of the gear actuating cylinders for retraction.

† Airplanes not changed by T.O. 1T-39-770
‡ Airplanes changed by T.O. 1T-39-770

LANDING GEAR DOWNLOCK OVERRIDE BUTTON.

When the weight of the airplane is on the landing gear, the gear handle is locked in the DOWN position. If it is necessary to retract the gear during take-off or landing while in this locked-down condition, and hydraulic pressure is available, the landing gear handle may be moved to UP while the downlock override button (figure 1-23) is pressed. The downlock override button is above the gear handle. Pressing the downlock override button retracts the solenoid-operated lock mechanically. Normally, when the airplane becomes airborne, the solenoid is energized to withdraw the lock and permit movement of the landing gear handle. On some airplanes, ‡ the landing gear handle can, if necessary, be moved from UP to DOWN by first pressing and holding the downlock override button.

LANDING GEAR EMERGENCY RELEASE "T" HANDLE.

The landing gear emergency release "T" handle (figure 1-23), on the pilot's instrument subpanel, is used to lower the gear in case hydraulic or electrical system failure prevents normal gear lowering. When the handle is EXTENDED (pulled to its full extension of about 11 inches, with a maximum pull of about 35 pounds), all fairing doors and the gear uplocks are unlocked mechanically and a dump valve is opened to return hydraulic fluid from the actuating cylinders and the gear lowers by gravity.

Caution The gear emergency handle must be held fully extended until gear down-and-locked indications are obtained, because the dump valve returns to its normal closed position when the handle is IN (stowed).

- The emergency handle must be pulled to full extension (EXTENDED) to ensure release of all uplocks and proper positioning of the hydraulic selector valve and the dump valve. To prevent damage to the surrounding equipment, manually replace the handle to IN (stowed).

A hook is installed on the landing gear emergency release "T" handle which is used to secure the handle in the fully extended position. This hook fits into a placarded hole below the pilot's console. A switch in the landing-gear-up circuit is opened when the emergency handle is pulled and prevents possible gear retraction following release of the emergency handle. The switch must be reset for normal operation of the gear control circuit by the landing gear electric reset button in the cockpit. For landing gear emergency lowering procedure, see figure 3-9.

LANDING GEAR ELECTRIC RESET BUTTON.

The landing gear electric reset button (figure 1-23), on the pilot's instrument subpanel, must be used after the gear has been lowered by the emergency handle to permit subsequent gear retraction. Pressing this button resets the landing-gear-up circuit which is opened when the gear emergency release handle is pulled to lower the gear. On some airplanes,† the landing gear electric reset button also serves as a landing gear downlock electric reset button. Pressing the button neutralizes the landing gear selector valve, relieving back pressure on the landing gear downlocks and allowing the spring-loaded downlock pins to engage. When the button is released, the landing gear selector valve is repositioned to its original position.

LANDING GEAR POSITION INDICATOR LIGHTS.

The three green landing gear position indicator lights (11, figure 1-26) are on the center of the instrument panel. The lights are arranged to represent the right and left gear and the nose gear. Each light comes on when the respective gear is down and locked. The dimming of the landing gear position indicator lights for night flight is controlled by the flight instrument indirect light rheostat on the pilot's console.

LANDING GEAR WARNING SYSTEM.

The landing gear warning system consists of an audible warning through the pilot's headset and/or speaker, a warning horn, and a flashing or steady red light in the landing gear handle. The system is designed to warn of an unsafe airplane landing configuration. The landing gear warning system is powered by the dc essential bus.

Landing Gear Audio Warning Signal.

The landing gear audio warning signal is heard in the pilot's headset and/or the cockpit speaker. This signal warns the pilot that the airplane is below preset limits (refer to "Landing Gear Warning Light") that may require the extension of the landing gear. The audio warning may be silenced by any one of the following: increasing airspeed to exceed approximately 160 knots IAS, advancing both throttles above 95 percent rpm, increasing altitude to above approximately 10,000 feet, or pressing the horn cutout button.

Landing Gear Warning Light.

The landing gear warning light (13, figure 1-26) is in the landing gear handle. A steady red light will indicate an unsafe landing gear condition when the landing gear position does not correspond to the landing gear handle position. In addition, a flashing red light in the handle, with the landing gear in the UP position, will indicate that the airplane pressure altitude is less than 10,000 feet, the airspeed is less than 145 (±5) knots IAS, and either throttle position is less than 95 percent rpm. The warning light will go out when the landing gear are locked in DOWN position, or the altitude, IAS, and engine rpm are above limits. The lamps are tested by actuating the caution light test switch. (See figure 4-11.)

Landing Gear Warning Horn Cutout Button.

The landing gear warning horn cutout button (figure 1-23) is to the right of the landing gear handle. This button is pushed to silence the landing gear warning horn. The horn circuit is reset automatically when both throttles are advanced above 95 percent. The red light in the gear handle is not affected by the horn cutout button.

NOSE WHEEL STEERING SYSTEM.

The nose wheel steering system (figure 1-24) allows the nose wheels, through normal pilot effort, to be turned approximately 24 degrees each side of center. With a heavier than normal rudder pedal force, the nose wheels may be turned 31 degrees each side of center. The nose wheel steering system is hydraulically powered, electrically actuated, and mechanically controlled. The steering system receives electrical power from the dc essential bus and hydraulic power from the normal hydraulic system. If normal hydraulic pressure is lost, an auxiliary accumulator can be selected by a switch in the cockpit to supply auxiliary pressure for the steering system (in addition to pressure for the wheel brakes, the speed brake, and the emergency hydraulic power transmitter). The steering system is operable when the weight of the airplane is on the gear. Depression of either right or left main landing gear load switch and the nose gear load switch will complete the necessary electrical circuits required to permit steering operation. The system is engaged and disengaged by a push-button switch on the pilot's or copilot's control wheel. When either button is actuated, a solenoid valve is opened, directing hydraulic pressure to the steering system. When the system is engaged, movement of either the pilot's or copilot's rudder pedals mechanically varies the position of the electrical control potentiometer in the steering system. This energizes the steering control valve to route the hydraulic pressure to the proper side of the steering cylinder piston, moving the nose wheels right or left. Movement of the nose wheels actuates a follow-up system, and the wheels continue to travel in the desired direction as long as the portion of the steering control system responding to pedal position remains ahead of the follow-up system. When the nose wheels reach a position corresponding to the position of the rudder pedals, the steering control and follow-up systems become electrically balanced. This balance condition de-

†AF62-4448 and all later airplanes

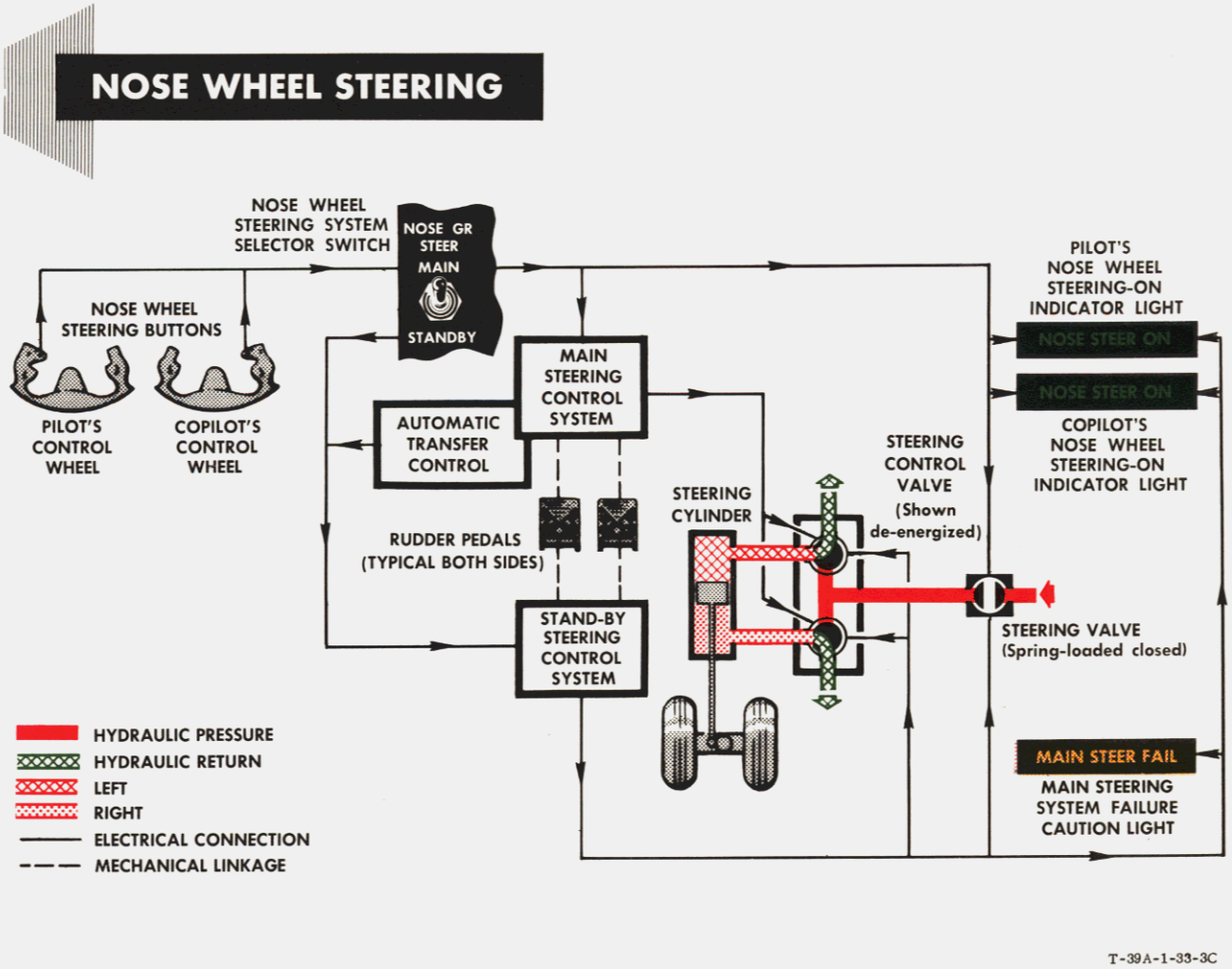


Figure 1-24

energizes the solenoid valve, and hydraulic pressure to the steering cylinder is shut off. Subsequent movement of the pedals upsets the electrical balance so that the control valve becomes energized and hydraulic pressure to the steering cylinder moves the nose wheels to the new position demanded by the position of the rudder pedals. When the nose wheel steering system is disengaged (steering control valve de-energized), both sides of the steering cylinder are ported to the hydraulic system return through the steering control valve. The steering system has a dual electrical control system, consisting of a main system and a stand-by system incorporating an automatic change-over.

NOTE Automatic transfer will not take place until a nose wheel position requirement is sensed. Moving the rudder pedals will upset the electrical balance, and transfer to stand-by steering will occur.

For additional information, refer to "Nose Wheel Steering Operation" in Section VII.

NOSE WHEEL STEERING BUTTONS.

Two push-button switches (figure 1-20), one on the outboard grip of each control wheel, are powered by the dc essential bus and control hydraulic pressure for nose wheel steering. Pressing and releasing either button engages the steering system by opening a solenoid valve which supplies hydraulic pressure to the steering system. Movement of the rudder pedals will then turn the nose wheels. Pressing and releasing either button again, shuts off hydraulic pressure to the system and the nose wheels go to a trail position. The steering buttons do not function when the stand-by system is operating. (The steering system remains engaged when it is on stand-by control.)

NOSE WHEEL STEERING SYSTEM SELECTOR SWITCH.

The positive-position steering selector switch (figure 4-2), on the air conditioning system control

panel, is used for selecting main or stand-by control of the nose wheel steering system. During normal operations, the switch should be at the MAIN position so that main system control will be energized when nose wheel steering is engaged. If the main system fails when the selector switch is at MAIN, control of the nose wheel steering is transferred automatically to the stand-by system. (The selector switch remains at the MAIN position when transfer to the stand-by system occurs.) When the selector switch is moved to STANDBY, the stand-by steering system is engaged and the main steering system failure caution light is illuminated. The STANDBY position should be used for test purposes only. When the selector switch is at STANDBY (or when the stand-by system has been engaged automatically because of main system failure), there is no automatic transfer to the main system if the stand-by system fails. To return steering control from stand-by to main, the selector switch should be placed at MAIN. If the stand-by system has been engaged by the automatic transfer system, it is necessary to place the switch momentarily at STANDBY and then at MAIN to disengage the stand-by system. Under such a situation, the stand-by system cannot be disengaged if the main system malfunction that caused the transfer still exists. The nose wheel steering system selector switch is powered by the dc essential bus.

MAIN STEERING SYSTEM FAILURE CAUTION LIGHT.

The placard-type "MAIN STEER FAIL" amber caution light (figure 1-26) is on the caution-warning light panel. It comes on if the nose wheel steering main system fails and automatic transfer to the stand-by system has occurred, or if the nose wheel steering system selector switch is at STANDBY.

NOSE WHEEL STEERING-ON INDICATOR LIGHT.

The two placard-type "NOSE STEER ON" green indicator lights (2 and 6, figure 1-26) are on the instrument panel shroud, one on the left side for the pilot, the other on the right for the copilot. Both lights come on to show that the nose wheel steering system is on, whether the steering system is controlled by the main or the stand-by system.

NOSE WHEEL STEERING RELEASE LATCH.

A nose wheel steering release latch, on the front of the nose gear assembly just above the wheel, disengages the nose wheel steering cylinder from the nose wheel when the airplane is towed. The release latch has been designed so that it is impossible to connect a tow bar to the airplane without actuating the release latch. In case the ground crew fails to engage the spring-loaded release latch when the tow bar is disconnected, the release latch automatically drops into place when the rudder pedals are actuated during the initial phase of taxiing with nose gear steering engaged.

WHEEL BRAKE SYSTEM.

The hydraulic brake system consists of a combination power system and a manual emergency system. Hydraulic pressure for the wheel brake system is available from (1) the normal hydraulic system, (2) the auxiliary hydraulic system, and (3) the manual emergency system when the emergency brake control "T" handle is pulled out. The braking units, on each main landing gear wheel, consist of rotor and spot brake assemblies. Braking effect is obtained by toe action on the rudder pedals which meters hydraulic pressure to apply the brakes. The emergency braking system has its own fluid supply and separate brake lines to brake-mounted shuttle valves. Pulling the emergency brake control "T" handle in the cockpit will permit the brake master cylinders to function as conventional brake master cylinders when enough toe pressure is applied to the top of the rudder pedals.

Warning The brake pedals for the pilot's and copilot's positions are mechanically interconnected to the same brake control valve. Test results have verified that hold-down of the brake pedals in one crew position will prevent any pumping action to obtain effective braking with the emergency brakes selected. When the emergency brakes are being used, only one pilot should activate the brake pedals until effective braking action is obtained.

An auxiliary accumulator, selected by a switch in the cockpit, supplies auxiliary hydraulic pressure for the nose wheel steering, wheel brakes, speed brake, and emergency hydraulic power transmitter, if normal hydraulic pressure is lost.

NOTE Each main gear wheel is equipped with three fusible plugs that will melt and release tire pressure before the wheel and tire become dangerously overheated.

EMERGENCY BRAKE CONTROL "T" HANDLE.

The "EMERG. BRAKE" control handle (9, figure 1-5), on the center pedestal, is the rotate-to-stow type. This pull "T" handle incorporates a spring-loaded blade which provides a positive lock when the handle is in the extended position. By rotation of the handle 90 degrees counterclockwise, the handle is unlocked and may then be pushed in. The handle rotates 90 degrees clockwise as it returns to the normal stowed position. The emergency brake control handle converts the brake valves from a power type to a manual type. Then, by pushing on the top of the rudder pedals, braking will be proportional to the amount of effort exerted. The emergency brake system is supplied hydraulic

fluid from two small reservoirs in the nose wheel well. These reservoirs are depicted as the header tank on the hydraulic system schematic. The two reservoirs are connected to the wheel brake system by a common supply line.

PARKING BRAKE "T" HANDLE.

The parking brake "T" handle (57, figure 1-2) is on the pilot's instrument subpanel, to the right of the control column. To set the parking brakes, toe action is applied to the rudder pedals and the parking brake handle is pulled out. The parking brake may be set as long as hydraulic pressure is available in either accumulator. Hydraulic pressure required to release the parking brakes is obtained by toe pressure applied to the rudder pedals. The release of the parking brake is indicated by the "T" handle returning to the normal (in) position. The emergency brake control "T" handle must be pushed in if it has been used, before the parking brakes can be applied.

INSTRUMENTS.

The following paragraphs cover only instruments which are not part of a complete system, such as the fuel system, engines, etc.

PITOT-STATIC SYSTEM.

A complete, independently operated pitot-static system (figure 1-25) is provided for each set of pilot's and copilot's instruments. An alternate static-pressure source, common to both sets of instruments, is also provided. An airspeed and altitude warning switch incorporates two pitot-static pressure-sensing switches. When the airplane is below the preset airspeed and altitude limits, these switches close, completing a portion of the landing gear warning system. Guarded toggle-type selectors are provided on both the left and right instrument subpanels, for transferring from the primary static-pressure source to the alternate static-pressure source. Dual, electrically heated pitot-pressure heads are installed, one on each side of the fuselage, below the windshield.

AIRSPEED INDICATORS.

The airspeed indicators (6 and 33, figure 1-2) are essentially conventional airspeed indicators with the addition of a maximum allowable airspeed pointer which indicates the maximum speed at which the airplane can be flown at any particular altitude. A vernier scale, visible through a window at the top center of the main dial, makes one revolution for each 100 knots change in airspeed. Graduations on this scale are provided for each 2 knots.

MACH INDICATOR.

A Mach indicator (3, figure 1-2) is provided to give a more usable speed indication at higher altitudes by indicating the ratio of airplane speed to the speed of sound at the particular altitude and temperature existing during any period of flight. A single pointer indicates the Mach number on a dial face graduated in tenths.

MACH-AIRSPEED AUDIBLE WARNING SYSTEM.

Audible warning that the airplane is at the limit Mach number is provided by the Mach-airspeed audible warning system. The system includes a pitot-static pressure-sensing switch, a relay, a warning horn, and related wiring. The horn is on the bulkhead behind the pilot. Below 21,100 feet pressure altitude, an interrupted tone will be heard from the warning horn and in the pilot's and copilot's headsets when the airspeed reaches 350 (±3) knots IAS. Above 21,100 feet pressure altitude, the horn and headset signals occur when the airspeed is between an indicated Mach number of .763 to .782. The system is powered by the dc essential bus and can be tested by the Mach-airspeed warning test button (2, figure 1-2).

Mach-Airspeed Warning Test Button.

This push button (2, figure 1-2) controls dc essential bus power for testing the Mach-airspeed audible warning system. The button is labeled "MACH-A/S WARNING TEST." Pressing the button energizes the warning system relay, causing the horn to sound and the tone to be heard in the headsets.

NOTE The tone heard in the headsets will not be reproduced by the cockpit loud-speaker.

VERTICAL VELOCITY INDICATORS.

The vertical velocity indicators (12 and 40, figure 1-2) indicate the airplane rate of climb or descent in feet per minute, or provide an indication of level flight. Actuation of the pointer is controlled by the rate of change of atmospheric pressure.

ALTIMETER.

This airplane is equipped with an altimeter (13 and 44, figure 1-2) that incorporates integral lighting and the standard 1000- and 100-foot pointers plus a 10,000-foot pointer. This 10,000-foot pointer extends from a center disk to the edge of the dial so that it cannot be obscured by the other pointers. The center disk has a wedge-shaped cutout through which a set of warning stripes appears at altitudes below 16,000 feet. To provide improved readability of the 10,000-foot pointer, some altimeters have a white ring on the right side of the indicator, under the outer periphery of the center disk. As the 10,000-foot pointer and disk move, this ring becomes progressively unmasked. On this altimeter, the below-16,000-foot warning stripes are on the left side of the instrument face instead of on the bottom.

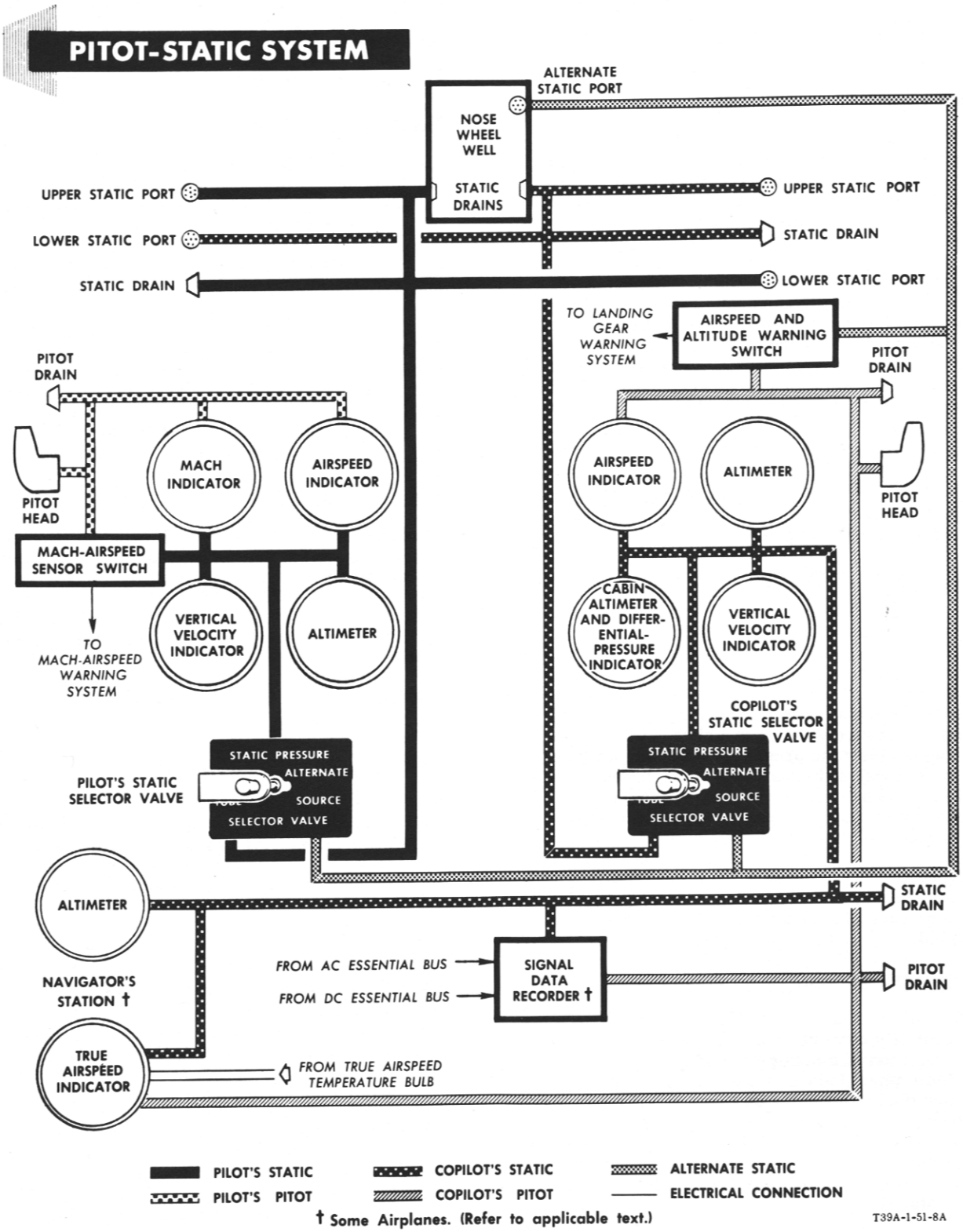

PITOT-STATIC SYSTEM
ALTERNATE STATIC PORT
NOSE WHEEL WELL
STATIC DRAINS
UPPER STATIC PORT
LOWER STATIC PORT
STATIC DRAIN
UPPER STATIC PORT
STATIC DRAIN
LOWER STATIC PORT
TO LANDING GEAR WARNING SYSTEM
AIRSPEED AND ALTITUDE WARNING SWITCH
PITOT DRAIN
PITOT DRAIN
PITOT HEAD
MACH INDICATOR
AIRSPEED INDICATOR
MACH-AIRSPEED SENSOR SWITCH
VERTICAL VELOCITY INDICATOR
ALTIMETER
TO MACH-AIRSPEED WARNING SYSTEM
AIRSPEED INDICATOR
ALTIMETER
PITOT HEAD
CABIN ALTIMETER AND DIFFERENTIAL-PRESSURE INDICATOR
VERTICAL VELOCITY INDICATOR
COPILOT'S STATIC SELECTOR VALVE
PILOT'S STATIC SELECTOR VALVE
STATIC PRESSURE ALTERNATE SOURCE SELECTOR VALVE
STATIC PRESSURE ALTERNATE SOURCE SELECTOR VALVE
ALTIMETER
STATIC DRAIN
NAVIGATOR'S STATION †
FROM AC ESSENTIAL BUS
FROM DC ESSENTIAL BUS
SIGNAL DATA RECORDER †
PITOT DRAIN
TRUE AIRSPEED INDICATOR
FROM TRUE AIRSPEED TEMPERATURE BULB
PILOT'S STATIC
COPILOT'S STATIC
ALTERNATE STATIC
PILOT'S PITOT
COPILOT'S PITOT
ELECTRICAL CONNECTION
† Some Airplanes. (Refer to applicable text.)
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Figure 1-25

ATTITUDE DIRECTOR INDICATOR.

The attitude director indicator (ADI), on the pilot's inboard instrument panel, is a multiple-purpose instrument (11, figure 1-2). Airplane attitude information is presented by the ADI in the same manner as by the MM-3 attitude indicator. (Refer to "MM-3 Attitude Indicator" in this section.) Turn-and-slip information presented by the ADI is derived in the same manner as for the conventional turn-and-slip indicator. (Refer to "Turn-and-Slip Indicator" in this section.) The ADI also presents navigation information provided by the flight director system. (Refer to "Flight Director System" in Section IV.)

MM-3 ATTITUDE INDICATOR.

The MM-3 attitude indicator (36, figure 1-2) on the copilot's outer panel, is operated by signals from an MD-1 vertical gyro. Separate vertical gyros are provided for the MM-3 attitude indicator and the flight director system. The MD-1 gyro senses pitch-and-bank angles and incorporates a pitch-and-bank erection system that reduces turning errors to a minimum. Acceleration and deceleration cause slight errors in pitch indications which are most noticeable on take-off. Horizontal markings with 5 degrees of separation on the face of the sphere show accurate airplane attitudes up to 82 degrees of climb or dive. Bank angles are read on a semicircular index scale on the upper half of the instrument. The pitch trim knob, on the lower right side of the instrument, electrically rotates the sphere to the proper position in relation to the fixed miniature airplane. An attitude warning flag uncovers the word "OFF" whenever the instrument is unreliable. The system starts operating as soon as power from the ac essential bus is available, but the word "OFF" is not covered until after a warm-up period of about 1-1/2 minutes. The word "OFF" also appears in case of a complete failure of 3-phase ac instrument bus power.

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Warning A slight reduction in electrical power, or failure of certain electrical components within the system will not cause "OFF" to appear even though the system is not functioning properly. Therefore, periodically in flight, the attitude indications given should be checked against other flight instruments.

TURN-AND-SLIP INDICATOR.

A conventional 4-minute turn-and-slip indicator (45, figure 1-2) is installed on the copilot's outer instrument panel. Electrical power for this indicator is provided by the dc essential bus.

ACCELEROMETER.

A three-pointer accelerometer (30, figure 1-2) is on the copilot's outer instrument panel. In addition to the indicating pointer, there are two recording pointers (one for positive G-loads and one for negative G-loads) which follow the indicating pointer to its maximum attained travel, and remain at the maximum travel positions reached by the indicating pointer. Pressing the knob on the instrument ring returns the recording pointers to the normal (1 G) position.

MAGNETIC COMPASS.

A conventional magnetic compass (12, figure 1-6), suspended from the center windshield divider, is furnished for navigation in case of instrument or electrical system failure. The magnetic compass light is controlled by the indirect portion of the pedestal and overhead light rheostat, on the interior light panel of the center pedestal. (Refer to "Lighting Equipment" in Section IV.) The compass correction card is also on the center windshield divider, immediately below the compass. The magnetic compass is compensated with the engines running, and only the following items turned off:

- TACAN
- Instrument and panel indirect lights
- Pitot heat

NOTE During ground operations, with the ground equipment blower on, the magnetic compass will be affected. This blower is de-energized when the airplane becomes air-borne.

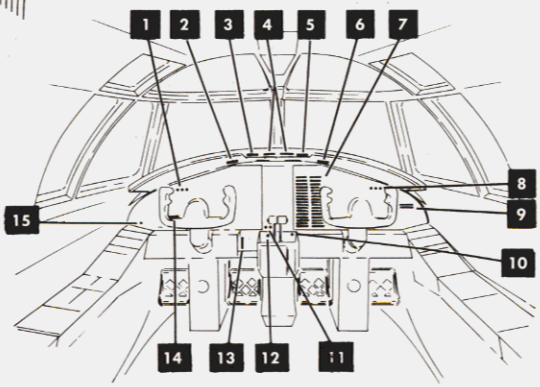
INDICATOR, CAUTION, AND WARNING LIGHTS - CROSS REFERENCE

For additional information, refer to "Caution Lights" in alphabetical index.

LIGHT	CONDITION
"HYD PRESS/PWR OFF"	Electrical power to hydraulic pump interrupted, or hydraulic pressure below normal.
"LH (RH) OIL OHEAT"	Oil temperature exceeds 121° C.
"AFT FUS OHEAT"	Temperature in vicinity of pressurization ducts exceeds 275°F.
"CABIN PRESS FAIL"	Cabin altitude exceeds 10,000 feet.
"DOOR OPEN"	Entrance door or in-flight escape hatch unlocked.
"ICING CONDITION" †	Ice detected in engine inlet duct.
"LH (RH) ENG DE-ICE FAIL"	Either of the respective engine anti-ice valves do not correspond to switch position or insufficient compressor bleed air.
"FUEL SHUTOFF FAIL"	Shutoff valve position does not agree with engine master switch position or fire pull "T" handles.
"FUEL FILTER BLOCK"	Fuel pressure drop across filter exceeds 7 to 8 pounds.
"LH (RH) FUEL HEAT ON"	Respective fuel heat valve open.
"FUEL TANK X-FD FAIL"	Fuel tank cross-feed valve does not agree with cross-feed switch position.
"LH (RH) FUEL PRESS LOW"	Boost pump or engine-driven centrifugal boost pump failure.
"LOW FUEL LEVEL"	Either fuel quantity gage indicates below 300 pounds fuel remaining.
"LH (RH) AC GEN OHEAT"	Respective ac generator overheated.
"LH (RH) DC GEN OHEAT" †	Respective dc generator overheated.
"LH (RH) AC GEN OFF"	Respective windshield ac generator fails or is turned off.
"AC INST PWR OFF"	AC essential bus not energized.
"MAIN STEER FAIL"	Nose wheel steering main system fails and transfers to stand-by system, or nose wheel steering system selector switch at STANDBY.
"PRESS DUCT FAIL"	Bleed-air pressure in normal cabin pressurization duct falls below preset pressure.
"CABIN AIR OHEAT"	Air temperature downstream of hot-air mixing valve exceeds 265°F.
"WINDSHIELD OHEAT"	Affected windshield overheated.
"SPEED BRAKE OPEN"	Speed brake not closed and either throttle above 95 percent rpm.
"MAIN INVERTER FAIL"	Main inverter fails or inverter switch at STANDBY.
"FUEL JETTISON OPEN"	Fuel jettison switch at AUTOMATIC or MANUAL or valves fail open.
"FUEL PUMP X-FD FAIL"	Position of cross-feed valve does not correspond to that of fuel cross-feed switch or fuel jettison switch.
"OIL PRESS LOW"	Either oil pressure drops below 28 (±1) psi.
"DC GEN OFF"	Either dc generator fails or is taken off the line.
"PILOT C SEL FAIL"	Failure of switching relay in indicator switching package.
"COPILOT C SEL INOP"	Pilot's and copilot's course selector switches at same position.
"COPILOT C SEL FAIL"	Failure of switching relay in indicator switching package.
"NOSE STEER ON"	Nose wheel steering engaged.

†Some airplanes. (Refer to applicable text.)

INDICATOR, CAUTION, AND WARNING LIGHTS



HYD PRESS / PWR OFF		MAIN STEER FAIL
LH OIL OHEAT		RH OIL OHEAT
AFT FUS OHEAT		PRESS DUCT FAIL
CABIN PRESS FAIL		CABIN AIR OHEAT
DOOR OPEN	7	WINDSHIELD OHEAT
† ICING CONDITION		SPEED BRAKE OPEN
LH ENG DE-ICE FAIL		RH ENG DE-ICE FAIL
FUEL SHUTOFF FAIL		MAIN INVERTER FAIL
FUEL FILTER BLOCK		FUEL JETTISON OPEN
LH FUEL HEAT ON		RH FUEL HEAT ON
FUEL TANK X-FD FAIL		FUEL PUMP X-FD FAIL
LH FUEL PRESS LOW		RH FUEL PRESS LOW
LOW FUEL LEVEL		OIL PRESS LOW
LH AC GEN OHEAT		RH AC GEN OHEAT
† LH DC GEN OHEAT		† RH DC GEN OHEAT
LH AC GEN OFF		DC GEN OFF
AC INST PWR OFF		RH AC GEN OFF

9 COURSE SELECT INOPERATIVE AND FAIL

COPILOT C SEL INOP

COPILOT C SEL FAIL

2 **6** NOSE STEER ON

NOSE WHEEL STEERING ON INDICATOR LIGHT

3 **5** MASTER CAUTION

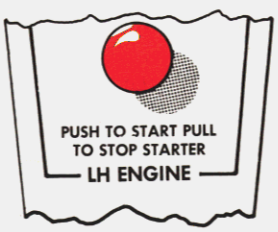
4 FIRE WARNING LIGHT

FIRE PULL

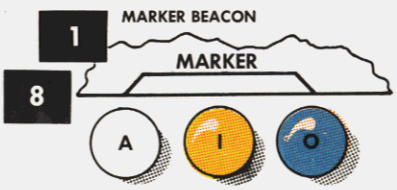
14 COURSE SELECT FAILURE

PILOT C SEL FAIL

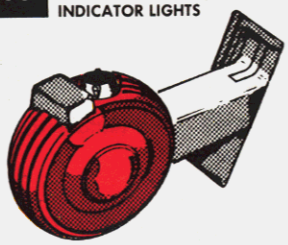
11 LANDING GEAR POSITION INDICATOR LIGHTS



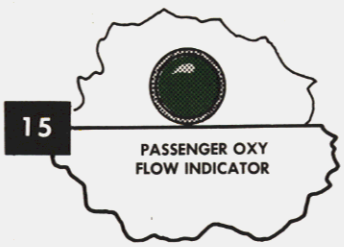
12 IGNITION-ON WARNING LIGHT



1 **8** MARKER BEACON

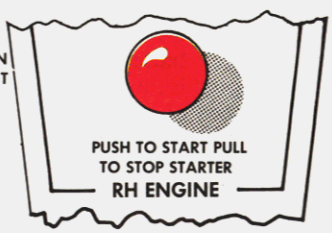


13 LANDING GEAR WARNING LIGHT



15 PASSENGER OXY FLOW INDICATOR

10 IGNITION-ON WARNING LIGHT



NEW † Some airplanes. (Refer to applicable text.)

39A-1-00-8K

Figure 1-26

FREE AIR TEMPERATURE INDICATOR.

One free air temperature indicator is mounted on the copilot's outboard instrument panel (31, figure 1-2), and is powered by the dc essential bus. The indicator needle is connected to the thermometer resistance bulb, so that changes in outside air temperature will register on the indicator face by means of changes in electrical current between the bulb and indicator. The indicator is calibrated in degrees centigrade. A ram-air recovery coefficient of 0.62 should be used for free air computations.

FLIGHT DIRECTOR SYSTEM.

Refer to "Flight Director System" in Section IV.

INDICATOR, CAUTION, AND WARNING LIGHT SYSTEM.

A caution-warning light panel, on the copilot's inboard instrument panel, contains two banks of placard-type caution lights and one warning light. (See figure 1-26.) All of the placard-type lights on the caution-warning light panel are amber caution lights except one, the "CABIN PRESS FAIL," which is a red warning light. Two amber master caution lights are installed in the cockpit, one in front of the pilot on the instrument panel shroud, and one in front of the copilot on the instrument panel shroud. Both master caution lights come on whenever any one of the placard-type caution lights or the warning light is initially illuminated. This alerts the pilot or copilot to check the placard-type lights on the instrument panel to determine which system is malfunctioning. The master caution lights may be extinguished by momentarily pressing either light. This leaves only the placard-type caution light on until the fault is cleared. There are other caution and warning lights in the cockpit that do not illuminate the master caution lights when they come on. They are the two red starter button ignition-on warning lights, the red landing gear unsafe warning light, the amber course select fail caution lights, and the red warning lights in the fire pull "T" handles. In addition, there is one condition in which the master caution light will not come on when the hydraulic pressure power off caution light is on. (Refer to "Hydraulic Pressure/Power Off Caution Light" in this section.) Indicator lights in the cockpit are the white, purple, and amber marker beacon lights; the three green landing gear position indicator lights; the green passengers' oxygen flow indicator light; and the two green nose wheel steering-on indicator lights.

CAUTION LIGHT TEST SWITCH.

A caution light test switch, on the interior light and speaker control panel (3, figure 1-6), is powered by the dc essential bus. The switch has three positions - BRIGHT, DIM, and OFF (center) - and is spring-loaded to the OFF position. When the switch is actuated in either the BRIGHT or DIM position, the respective circuit of all placard-type caution lights, master caution lights, and indicator and warning lights (except the ignition-on warning lights and the warning lights in the engine fire pull "T" handles) comes on to indicate any defective lamps.

INDICATOR, CAUTION, AND WARNING LIGHTS.

All indicator, caution, and warning lights are powered by the dc essential bus. The pilot's flight instrument lights rheostat provides the dimming control for all indicator, caution, and warning lights except the ignition-on lights and the warning lights in the engine fire pull "T" handles. (Refer to "Interior Lighting" in Section IV.) For details concerning an individual light, refer to the paragraph covering it in the respective system description. The indicator, caution, and warning lights cross-reference table is a ready reference. The left column shows the nomenclature as it appears on the light. The right column lists conditions that will illuminate the light. Systems having two lights to indicate left-hand or right-hand functions appear on the table as "LH (RH) . . ." light. All lights presented on illustrations in this manual are shown illuminated for information only.

EMERGENCY EQUIPMENT.

ENGINE FIRE AND OVERHEAT DETECTION SYSTEM.

A continuous-element type alarm circuit is installed in each engine pod to detect any engine fire or overheat condition. A sealed fire wall in each engine pod separates the forward fire section from the aft overheat section. The fire and overheat detection system is controlled by a hermetically sealed control unit powered by 28-volt dc through the essential bus. When a fire or overheat condition exists, a red warning light comes on.

Fire Warning Lights.

Red fire warning lights, in the engine fire pull "T" handles (4, figure 1-26), are provided to warn of an overheat or fire condition in either engine pod. When a fire or overheat condition is detected, the warning light in the engine fire pull "T" handle for the respective pod will illuminate.

Fire and Overheat Detection Circuit Test Button.

This button (figure 1-27), on the fire emergency control panel, is used to test the engine fire and overheat detection circuits and the aft fuselage overheat detector circuit. Pressing the button will illuminate both engine fire pull "T" handles, the master caution lights, and the aft fuselage overheat caution light if the circuits are continuous and

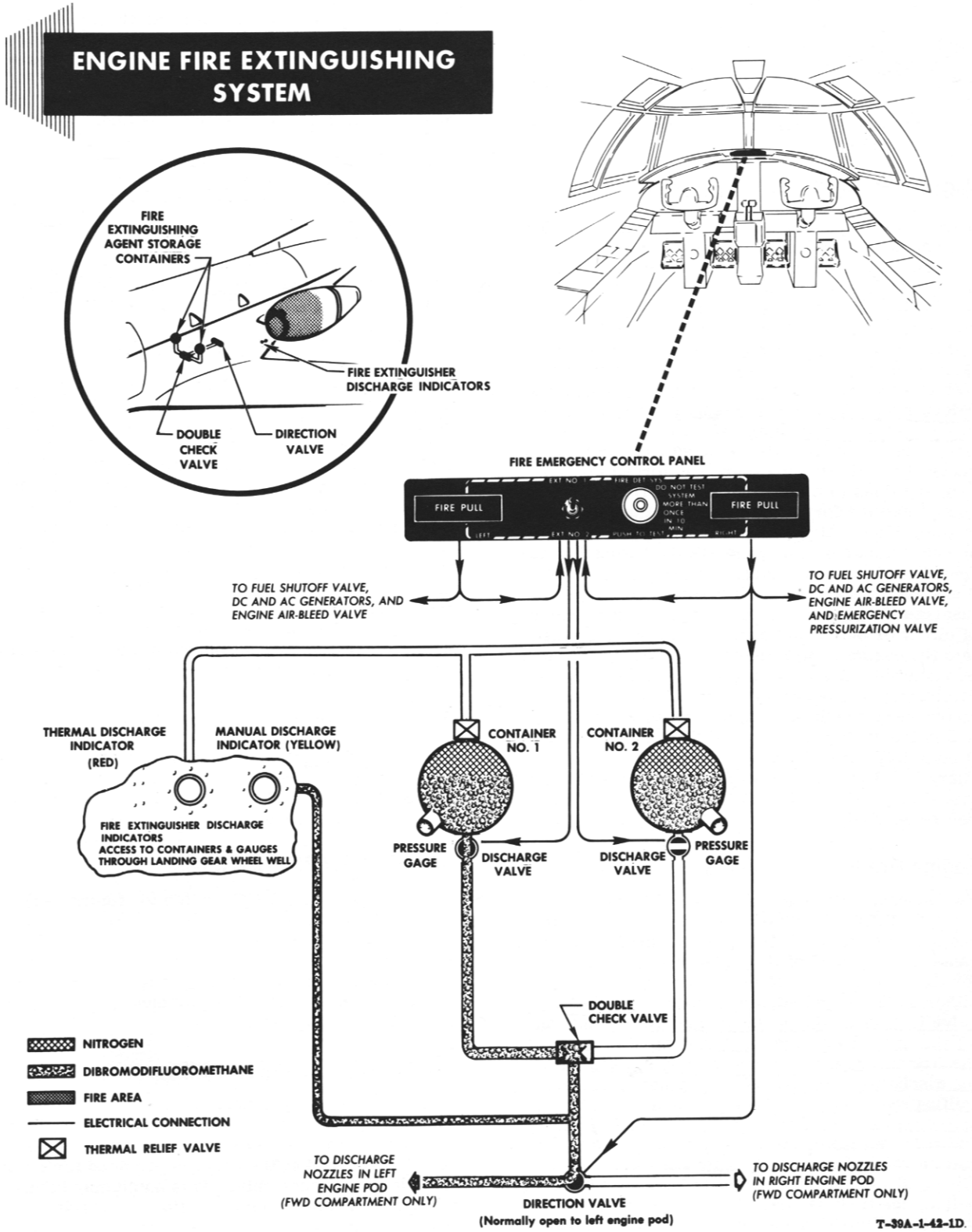

ENGINE FIRE EXTINGUISHING SYSTEM
FIRE EXTINGUISHING AGENT STORAGE CONTAINERS
FIRE EXTINGUISHER DISCHARGE INDICATORS
DOUBLE CHECK VALVE
DIRECTION VALVE
FIRE EMERGENCY CONTROL PANEL
FIRE PULL
DO NOT TEST SYSTEM MORE THAN ONCE IN 10 MIN
FIRE PULL
TO FUEL SHUTOFF VALVE, DC AND AC GENERATORS, AND ENGINE AIR-BLEED VALVE
TO FUEL SHUTOFF VALVE, DC AND AC GENERATORS, ENGINE AIR-BLEED VALVE, AND EMERGENCY PRESSURIZATION VALVE
THERMAL DISCHARGE INDICATOR (RED)
MANUAL DISCHARGE INDICATOR (YELLOW)
FIRE EXTINGUISHER DISCHARGE INDICATORS
ACCESS TO CONTAINERS & GAUGES THROUGH LANDING GEAR WHEEL WELL
CONTAINER NO. 1
CONTAINER NO. 2
PRESSURE GAGE
DISCHARGE VALVE
DISCHARGE VALVE
PRESSURE GAGE
DOUBLE CHECK VALVE
NITROGEN
DIBROMODIFLUOROMETHANE
FIRE AREA
ELECTRICAL CONNECTION
THERMAL RELIEF VALVE
TO DISCHARGE NOZZLES IN LEFT ENGINE POD (FWD COMPARTMENT ONLY)
TO DISCHARGE NOZZLES IN RIGHT ENGINE POD (FWD COMPARTMENT ONLY)
DIRECTION VALVE
(Normally open to left engine pod)
T-39A-1-42-1D.

Figure 1-27

the control units are in proper operating condition. The button is powered by the dc essential bus.

Caution Do not test the fire detection system more than once in any 10-minute period, as damage may result if relays are not allowed to cool sufficiently.

ENGINE FIRE-EXTINGUISHING SYSTEM.

A high-rate-of-discharge, fixed fire-extinguishing system is provided in the forward compartment of each engine. Dibromodifluoromethane, used as the agent, is stored under pressure in two spherical containers. A pressure gage on each container is visible from the main wheel well. On the bottom of each container is a discharge valve containing an explosive cartridge that is ignited by 28-volt dc essential power when the fire extinguisher selector switch is actuated (engine fire pull "T" handle previously pulled). When a cartridge is fired, the contents of the selected container is discharged by nitrogen pressure and forced through delivery lines to a direction valve, from where it is routed into the forward compartment of the affected engine. The sealed fire wall, between the forward and aft compartments, prevents the extinguishing agent from entering the aft compartment. Two disk-type indicators are flush-mounted in the fuselage skin below the left engine. If the contents of either or both containers have been discharged into the engine compartments, the yellow disk will be ruptured. If either or both containers have been discharged overboard automatically as a result of an overheat condition causing excessive pressure within the containers, the red disk will be ruptured. If both disks are intact, the system is not discharged. The indicators are readily available for visual inspection and must be checked for condition before each flight.

Engine Fire Pull "T" Handles.

Two mechanically interconnected "T" handles labeled "FIRE PULL" (figure 1-27), one for each engine, are provided on the fire emergency control panel in the center of the instrument panel shroud, for the purpose of isolating either engine pod. When either handle is pulled, the respective fuel shutoff valve is closed, the dc and ac generators are taken off the line, the engine air-bleed valve is closed, the fire extinguisher selector switch is armed, and the discharge valve on each container is armed. Pulling the handle for the right engine positions the direction valve to route the agent to that engine, and removes power from the emergency pressurization valve (figure 4-1), allowing the valve to close. If the second engine fire pull "T" handle is pulled, the first handle automatically retracts to its original position and, except for the generator, those items previously turned off are reinstated, unless the engine master switch to the first engine has been placed in the OFF position.

Fire Extinguisher Selector Switch.

The fire extinguisher selector switch (figure 1-27), on the fire emergency control panel, is powered by the dc essential bus. The switch has three positions: EXTINGUISHER NO. 1, EXTINGUISHER NO. 2 (labeled "EXT NO. 1" and "EXT NO. 2"), and an unmarked OFF (center) position. When the selector switch is positioned to either EXTINGUISHER NO. 1 or EXTINGUISHER NO. 2 after having been armed by an engine fire pull "T" handle, the extinguishing agent from one container is discharged to the engine pod selected by the handle. After the initial container has been expended, the extinguisher selector switch may, if necessary, be positioned in the opposite direction to discharge the second container to the same engine.

AFT FUSELAGE OVERHEAT DETECTION SYSTEM.

A series of thermal switches surrounding the engine bleed air and pressurization ducts, in the aft fuselage section, detect abnormal temperature conditions (above 275°F) that may result from bleed air escaping from a ruptured duct or possible fire. The system warns of an overheat condition by automatically turning on the amber aft fuselage overheat light on the caution-warning light panel. When the detector circuit is tested by pressing the fire detection system test button, the aft fuselage caution light will come on. In addition, the fire pull "T" handle warning light and both master caution lights will also come on. The aft fuselage overheat detection system is independent of the engine fire and overheat detection system.

Aft Fuselage Overheat Caution Light.

The "AFT FUS OHEAT" amber caution light (figure 1-26) is on the caution-warning light panel and warns of an overheat condition around the bleed-air duct in the aft fuselage.

BAIL-OUT ALARM SWITCH.

The "BAILOUT ALARM" switch (8, figure 1-6), on the overhead control panel, is used to signal for emergency bail-out or ditching procedures. The switch is guarded in the OFF position. Raising the guard and moving the switch to ON rings a bell in the aft end of the cabin compartment. The switch is powered by the battery bus.

EMERGENCY ESCAPE HATCHES.

Of the three exits provided in this airplane, two are emergency exits and one is the normal entry or exit door. The plug-type, emergency escape hatch on the right side of the cabin is provided for ground and ditching escape only. This hatch may be unlocked by handles from the inside or outside of the airplane and lifted into the interior of the cabin compartment. An emergency in-flight escape hatch (figure 1-28) is also provided in the floor of the cabin, forward of the wing. This hatch permits

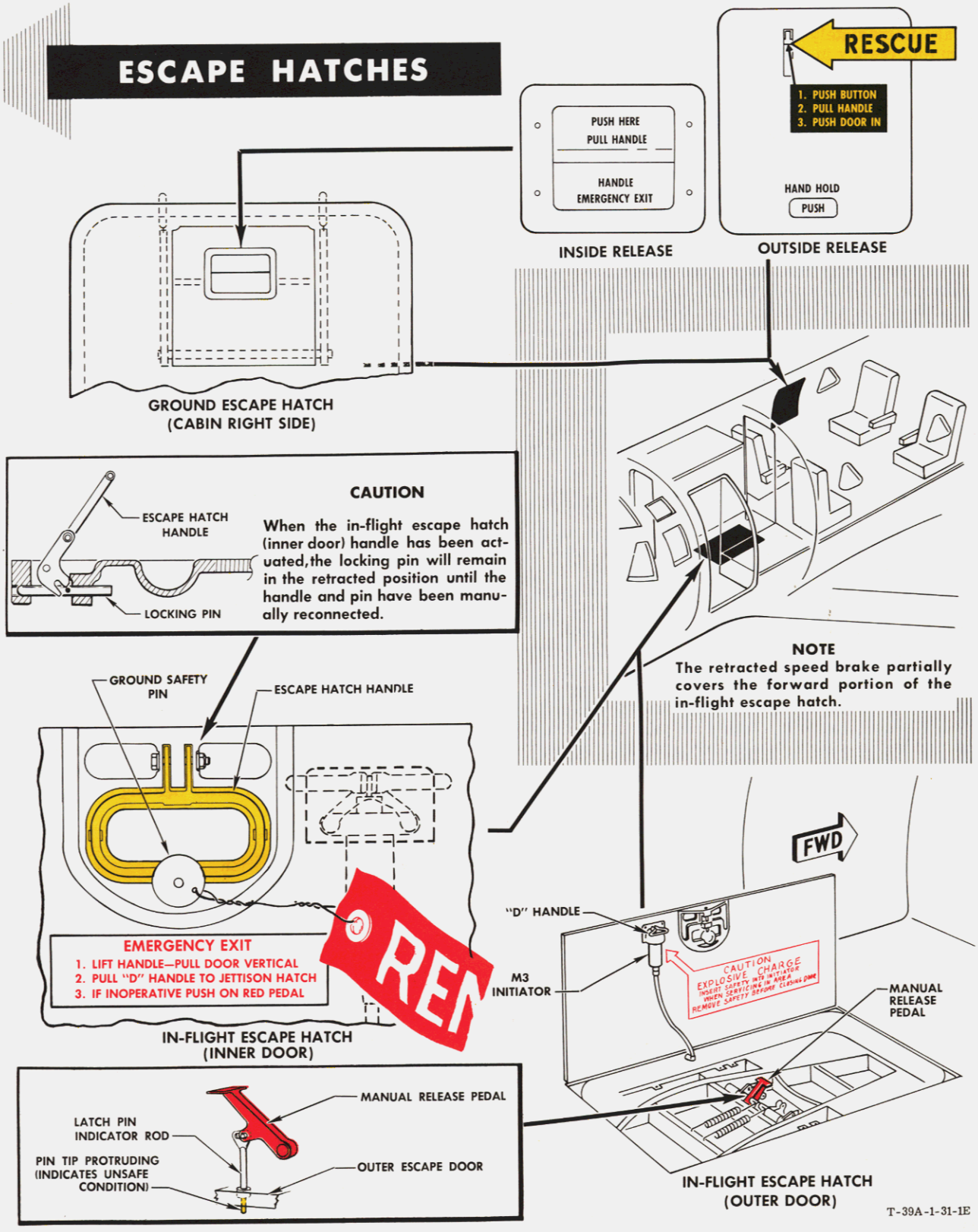

ESCAPE HATCHES
PUSH HERE
PULL HANDLE
HANDLE
EMERGENCY EXIT
INSIDE RELEASE
RESCUE
1. PUSH BUTTON
2. PULL HANDLE
3. PUSH DOOR IN
HAND HOLD
PUSH
OUTSIDE RELEASE
GROUND ESCAPE HATCH
(CABIN RIGHT SIDE)
ESCAPE HATCH
HANDLE
LOCKING PIN
CAUTION
When the in-flight escape hatch (inner door) handle has been actuated, the locking pin will remain in the retracted position until the handle and pin have been manually reconnected.
NOTE
The retracted speed brake partially covers the forward portion of the in-flight escape hatch.
GROUND SAFETY
PIN
ESCAPE HATCH HANDLE
EMERGENCY EXIT
1. LIFT HANDLE—PULL DOOR VERTICAL
2. PULL "D" HANDLE TO JETTISON HATCH
3. IF INOPERATIVE PUSH ON RED PEDAL
IN-FLIGHT ESCAPE HATCH
(INNER DOOR)
FWD
"D" HANDLE
M3
INITIATOR
CAUTION
EXPLOSIVE CHARGE
INSERT SAFETY WITH INITIATOR
WHEN SERVICING ARE IN AREA
REMOVE SAFETY BEFORE CLOSING DOOR
MANUAL
RELEASE
PEDAL
MANUAL RELEASE PEDAL
LATCH PIN
INDICATOR ROD
PIN TIP PROTRUDING
(INDICATES UNSAFE
CONDITION)
OUTER ESCAPE DOOR
IN-FLIGHT ESCAPE HATCH
(OUTER DOOR)
T-39A-1-31-1E

Figure 1-28

bail-out of passengers and crew through an opening protected from air blast by the extended speed brake immediately forward of the escape opening. The emergency in-flight escape hatch consists of two doors. The inner door opens inward and is held open by an automatically engaging latch on the partition at the forward end of the coat compartment. Provided that the hydraulic system is functioning, opening of the inner door automatically accomplishes three steps necessary to in-flight escape: (1) pressurization is lost by automatic opening of the dump valve; (2) the pressurization seals on the in-flight escape outer door and on the main entrance door are deflated; and (3) the speed brake is fully extended to provide a protective air space outside the escape hatch. In case the landing gear is retracted or if the hydraulic system has failed (normal and auxiliary system pressures depleted), step 3 will not occur upon opening of the inner door. However, when the outer door, which is exposed when the inner door is open, is jettisoned by pulling a handle on the bottom of the inner door, step 3 will be initiated if not already accomplished and the main landing gear doors will close if the landing gear has been extended. Pulling the "D" handle on the bottom side of the inner escape door will fire an initiator which in turn fires a gas generator unit which will produce more than 3000 psi of gas pressure. This pneumatic pressure, if hydraulic pressure is not available, is routed to the emergency escape system hydraulic power transmitter to extend the speed brake and retract the main wheel doors. Bleed-off pressure is also ported to another initiator which directs pressure to the door-mounted thruster unit which ejects the outer door clear of the airplane after the speed brake is extended (2-1/2 seconds after the handle is pulled). A red manual release pedal is also incorporated for use if the pressure-automatic system fails.

Caution When the red manual release pedal on the in-flight escape hatch (outer door) has been accidentally depressed, a yellow latch indicator pin attached to the pedal will protrude through the skin of the outer door, indicating that the door latch is in an unsafe condition.

NOTE Should the in-flight escape hatch (outer door) fail to eject (after the speed brake is extended), it can be released by pushing on the manual release pedal.

EMERGENCY LIGHTING.

Emergency lighting is provided in the interior of the airplane to be used in case of a complete electrical failure. A total of four emergency lamps are installed: one lamp is directed at each emergency escape hatch; one is directed at the main entrance door; and one in the cockpit on the bulkhead, aft and to the left of the copilot's head, is directed on the pilot's controls and panels. The four lamps are powered in pairs by two separate power units, each containing a sealed 7.2-volt, nickel-cadmium battery and a power-off sensing unit, which are connected to the airplane dc electrical system through the essential bus. Under normal operating conditions, dc essential bus power keeps the emergency power unit batteries charged. In case of essential bus failure, the emergency light units sense a voltage drop and automatically illuminate the emergency lights. Each battery will sustain its pair of lamps for approximately 30 minutes.

Emergency Light Switch.

The emergency light switch, on the lighting control panel (4, figure 1-6), is a three-position toggle-type switch with TEST, ARM, and DISARM positions. To check the emergency lights, batteries, and circuitry, position the switch to TEST; all four lights should illuminate. With the engines operating and the electrical master switch at ON, positioning the emergency light switch to ARM will put the circuit into a stand-by condition until there is a voltage drop in the dc essential bus. This voltage drop will automatically illuminate the emergency lights by the batteries in the power units. When power is applied to the dc essential bus and the emergency light switch is positioned at ARM, the emergency batteries will be recharged. To prevent battery discharge, the emergency light switch should always be placed in the DISARM position before switching the battery and electrical master switch to OFF when leaving the airplane. The emergency lighting should not be used to illuminate the interior of the airplane for cleaning or maintenance purposes, because several flight hours will be required for recharging the emergency light batteries before the emergency lighting can be relied on.

HAND FIRE EXTINGUISHER.

A portable CB, Type A-20 extinguisher (27, figure 1-1) is mounted on the cockpit bulkhead aft of the pilot's seat to be used by the crew for cockpit or cabin fires. Pressure on the extinguisher gage should read between 150 and 175 psi. This is indicated by a green arc on the gage glass. The extinguishing agent, bromochloromethane, can be used most effectively on normal combustion, hydrocarbon, or electrical fires.

Warning Prolonged exposure (5 minutes or more) to high concentrations of bromochloromethane (CB) or its decomposition products should be avoided. CB is an anesthetic agent of moderate intensity and will result in pronounced irritation of eyes and nose. It is safer to use than previously

used fire-extinguishing agents (carbon tetrachloride, methylbromide). However, especially in confined spaces, adequate respiratory and eye protection from excessive exposure, including the use of oxygen when available, should be sought as soon as the primary fire emergency will permit.

NOTE Bromochloromethane is highly corrosive to airplane metal, paint, and Plexiglas. If the extinguisher starts to leak, it should be inverted and, with the nozzle covered or aimed into a can or similar disposable container, the control valve should be depressed. This will release the stored charge of pressurizing gas with a minimum discharge of fluid and render the extinguisher harmless. The extinguisher should be returned to its mounting bracket and must be reported in the Form 781 for replacement.

FIRST-AID KIT.

The first-aid kit is mounted in the upper forward end of the baggage compartment or in the lower aft section of the coat compartment. On some airplanes,† it is on the outboard face of the baggage compartment fence, aft of the oxygen walk-around bottle.

EMERGENCY AX.

Stowage provisions are provided for an emergency ax (fire, crash, etc) on the forward bulkhead in the coat compartment. On some airplanes,† it is on the aft face of the crew-chief/passenger seat aft partition.

SMOKE GOGGLES.

Two pairs of smoke goggles are in a pouch attached to the bulkhead behind the copilot. The goggles are for emergency purposes only and may be worn by the pilot and copilot in case smoke enters the cockpit.

OXYGEN WALK-AROUND BOTTLE.

Refer to "Oxygen Walk-around Bottle" in Section IV.

ENTRANCE DOOR.

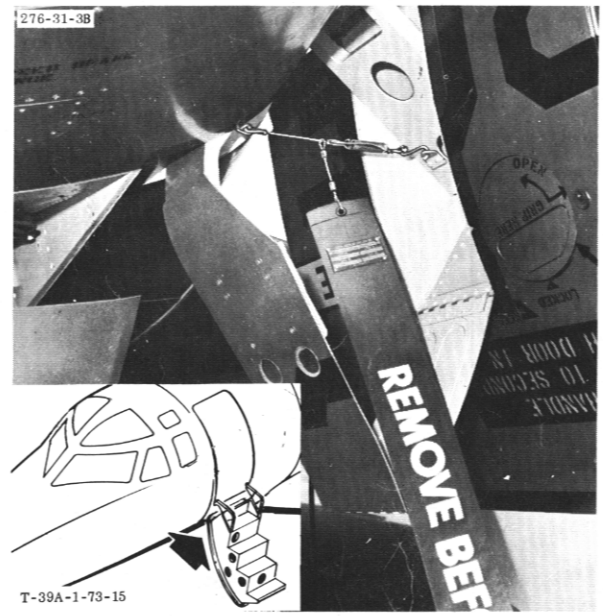
The plug-type entrance door (24, figure 1-1), on the left side of the fuselage, forward of the wing, serves a dual purpose. When this door and the in-flight escape hatch (outer door) are closed, an engine is running, and the weight of the airplane is off the landing gear, an inflatable seal pressurized by engine bleed air automatically seals the door. A flush-type rotary latch is provided on each side of the door, to be used as a handgrip while opening or closing the door. (See figure 2-2.) When the door is open, steps within the door provide easy access into the airplane. Helper springs within the structure facilitate raising or lowering the door. A caution light in the cockpit comes on when the door is not closed and locked.

DOOR-OPEN CAUTION LIGHT.

The "DOOR OPEN" amber caution light (figure 1-26), on the caution-warning light panel, is provided to indicate when the main entrance door or the inflight escape hatch is not closed and locked. The light is controlled by switches installed at the latches of the in-flight escape hatch inner and outer doors, and main entrance door. Illumination of the door-open caution light indicates that the main entrance door or in-flight escape hatch outer door is not fully locked closed, or that the in-flight escape hatch inner door has been raised. This light must be out before take-off.

ENTRANCE DOOR GROUND LOCK.

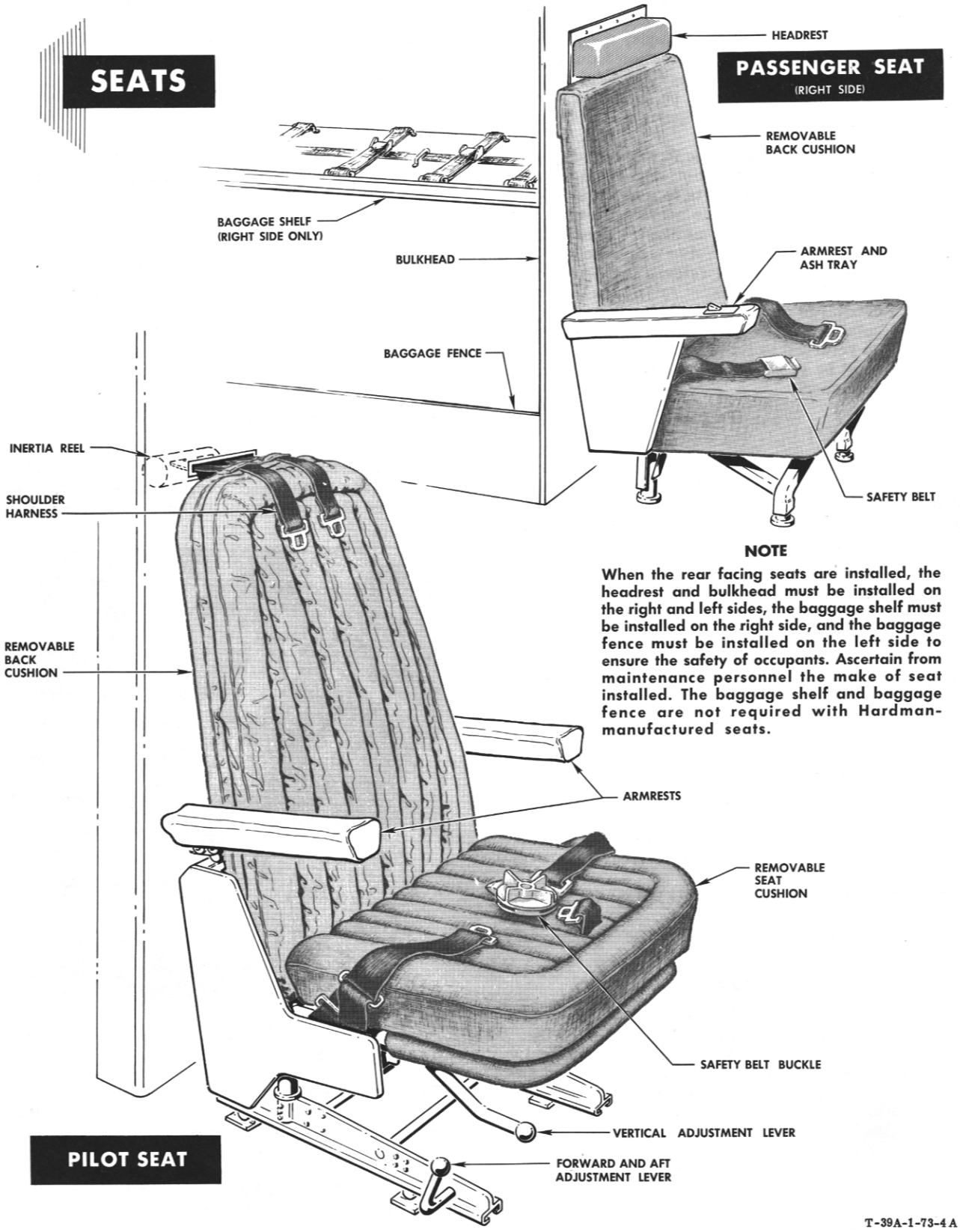
A bungee assembly may be installed on the entrance door to prevent wind gust damage to the door when the airplane is on the ground. The assembly, which has a red streamer, must be removed before flight.



PILOTS' SEATS.

Two crew seats (figure 1-29) are provided in the pilot's compartment. Each seat is equipped with a quick-disconnect combination lap belt and shoulder harness; two armrests, which raise upward and aft to a stowed position; removable seat and back cushions; and adjustment levers for vertical as well as fore-and-aft movement. The seat and back cushions are easily removed to accommodate a standard back-pack parachute and a survival seat pack.

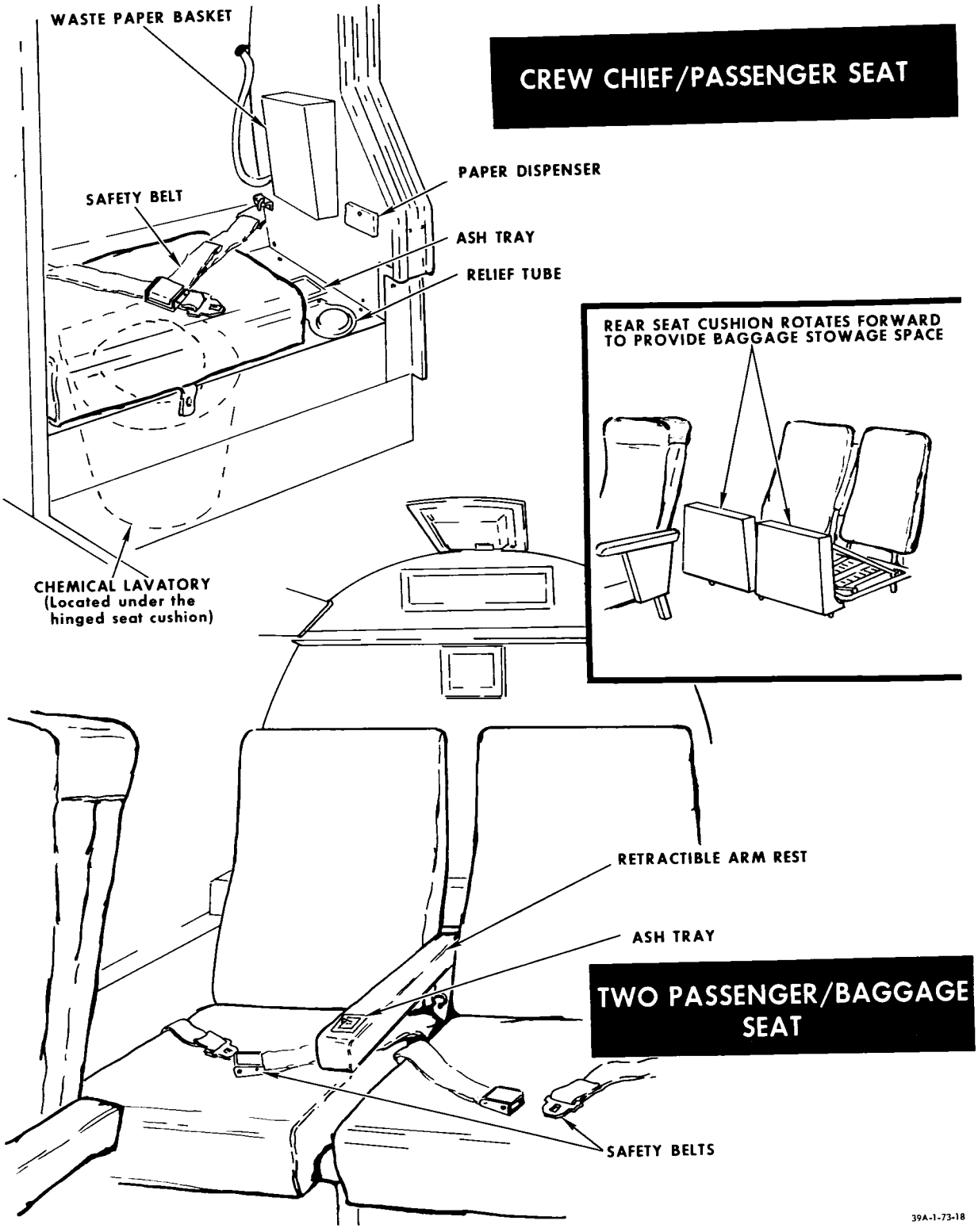
† Airplanes changed by T.O. 1T-39A-549



NOTE

When the rear facing seats are installed, the headrest and bulkhead must be installed on the right and left sides, the baggage shelf must be installed on the right side, and the baggage fence must be installed on the left side to ensure the safety of occupants. Ascertain from maintenance personnel the make of seat installed. The baggage shelf and baggage fence are not required with Hardman-manufactured seats.

Figure 1-29


WASTE PAPER BASKET
CREW CHIEF/PASSENGER SEAT
PAPER DISPENSER
SAFETY BELT
ASH TRAY
RELIEF TUBE
REAR SEAT CUSHION ROTATES FORWARD TO PROVIDE BAGGAGE STOWAGE SPACE
CHEMICAL LAVATORY (Located under the hinged seat cushion)
RETRACTIBLE ARM REST
ASH TRAY
TWO PASSENGER/BAGGAGE SEAT
SAFETY BELTS
39A-1-73-18

PILOTS' SEAT ADJUSTMENT.

The pilot's and copilot's seats may be individually adjusted manually by two levers (figure 1-29) beneath each seat on the inboard side. Fore-and-aft adjustment is accomplished by aft movement of the lever that extends upward from the floor. Vertical adjustment is accomplished by raising the horizontal lever and holding it in that position until the proper adjustment is made. Releasing the lever allows the locking pin to enter an adjustment hole. Both the vertical and horizontal adjustments are in 1/2-inch increments with a full travel of 5 inches.

SAFETY BELT AND SHOULDER HARNESS.

The pilot's and copilot's seats are equipped with an adjustable seat belt which is attached to the seat frame. The entire harness assembly (figure 1-29) consists of a lap belt, a crotch strap, and a shoulder harness. The lap belt and crotch strap are attached separately to the seat. Each strap has an attachment fitting which is inserted into a single, quick-release buckle attached to one side of the seat belt. Turning the face of the buckle approximately one eighth of a turn in either direction will immediately release all plug-in connections. In addition, there is an alternate release at the top of the buckle for the shoulder straps only. This feature permits the convenience of extended forward movement of the head and shoulders without releasing the complete harness assembly. A dual inertia reel for the shoulder harness straps is provided within the bulkhead immediately aft of each crew seat. No manual locking device is provided for the shoulder straps, as the automatic locking device within the inertia reel will lock at a maximum forward acceleration of 1.4 G and will function with the reel in any position. When the shoulder straps are released from the belt buckle, they will retract, eliminating the hazard of loose straps in the pilot's compartment.

PILOT'S SLIDING WINDOW.

The forward side window on the pilot's side may be opened on the ground. If necessary, the window may be opened in flight to aid in evacuation of smoke and fumes or during landing if forward vision is obscured. Refer to "Elimination of Smoke and Fumes" in Section III. The pilot's sliding window has a positive lock system that includes a hinge-type lock attached to the forward edge of the window frame. The lock has a tab for easy opening, and is labeled "OPEN HINGE BEFORE OPENING WINDOW. CLOSE HINGE AFTER CLOSING WINDOW." Moving the hinge outboard locks the window.

- To unlock and open the window:
  Pull hinge lock tab inboard. Grasp lock handle (at forward lower edge of window) and pull inboard to clear lock detent. Pull aft until window is fully opened; then push handle outboard into lock detent.
- To close and lock the window:
  Pull lock handle inboard to clear lock detent; then move handle forward until window is fully closed. Push handle outboard into lock detent. Move hinge lock tab outboard.

COCKPIT WATER DRAIN VALVE.

A water drain valve is flush-mounted in the fuselage skin below the left side of the cockpit. The valve can be used before flight to determine whether water has accumulated in the undercockpit area, and permits water to be drained from that area. The presence of trapped water can be checked by pressing in on the spring-loaded center of the valve. The valve is slotted for a screwdriver and is opened by a quarter turn of the slot. After the water has completely drained, the valve must be closed. (When the valve is closed, the slot in the center of the valve is aligned with the slot in the outer ring of the valve assembly.)

NOTE If the airplane has been parked outside during inclement weather, the valve is used before flight to make sure the area below the cockpit is free of water.

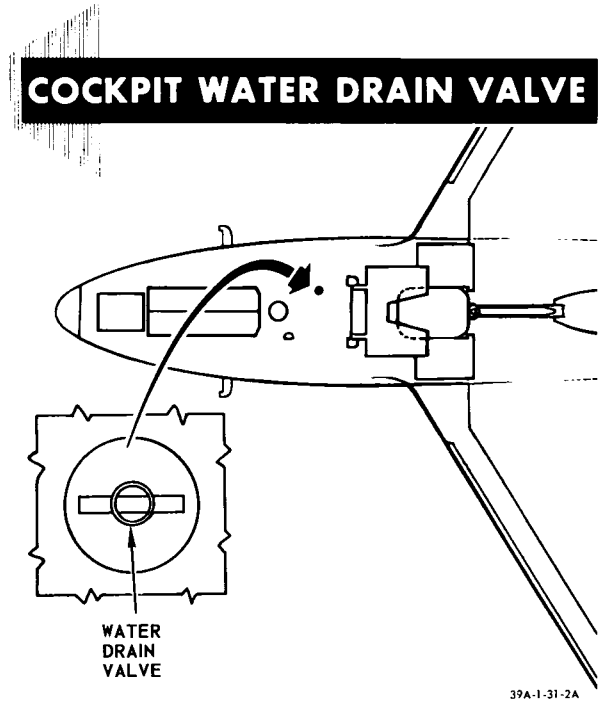


Figure 1-30

NOTE

- When using JP-5 or aviation gasoline, refer to "Alternate and Emergency Fuel Limitations" in Section V, "Operation on Alternate or Emergency Fuel" in Section VII, and "Fuel Specific Weight" in Part I of Appendix I.
- When emergency fuel is used, it is necessary to add 3 percent of Military Specification MIL-L-22851, Type II or Type III, Grade 1100, engine oil to the aviation gasoline for fuel pump lubrication. Aviation gasoline has poor lubricating properties, and the engine oil is necessary to prevent failure of the pump.
- When the NATO O-148 engine oil (Military Specification MIL-L-7808) is not available, NATO O-149 may be used or mixed with O-148 up to 50 percent. In such a case, when O-148 becomes available, the oil tank should be drained and filled with O-148.

SERVICING

NOTE

For detailed information on fuels, refer to T.O. 42 B1-1-14.

† Contains fuel icing inhibiter.

	TYPE FUEL	USAF–MILITARY SPECIFICATION		NATO SYMBOL	COMMERCIAL DESIGNATION
FUEL SPECIFIED	WIDE-CUT GASOLINE	J-4	MIL-T-5624	F-40†	ASTM TYPE B (JET B)
ALTERNATE	KEROSENE	NONE	NONE	NONE	ASTM TYPE A (JET A)
		NONE	NONE	F-34†	ASTM JET A-1
		NONE	NONE	F-42	NONE
		JP-5	MIL-T-5624	F-44	NONE
EMERGENCY	AVIATION GASOLINE	80/87	MIL-G-5572	F-12	AVGAS 80/87
		NONE	NONE	NONE	AVGAS 91/98
		100/130	MIL-G-5572	F-18	AVGAS 100/130
		NONE	NONE	NONE	AVGAS 108/135
		115/145	MIL-G-5572	F-22	AVGAS 115/145
ENGINE OIL			MIL-L-7808	O-148 O-149	
HYDRAULIC FLUID			MIL-H-5606	H-515	
OXYGEN			MIL-O-27210		
FIRE-EXTINGUISHING AGENT (ENGINE)			MIL-D-4540		

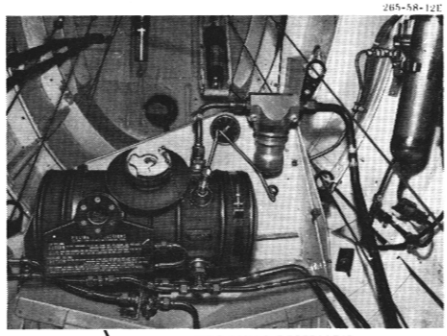
39A-1-00-46D

Figure 1-31

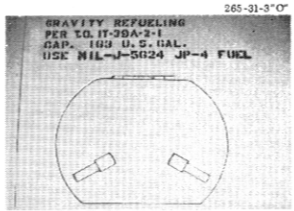
AUXILIARY EQUIPMENT.

The following auxiliary equipment is described in Section IV: air conditioning and pressurization system, anti-icing systems, deicing system, oxygen system, communications and associated electronic equipment, lighting equipment, navigation equipment, single-point refueling system, gravity refueling, miscellaneous equipment, and cargo loading equipment.

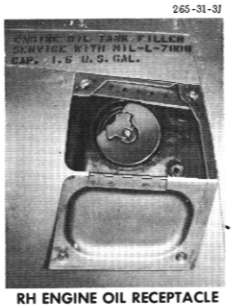
DIAGRAM



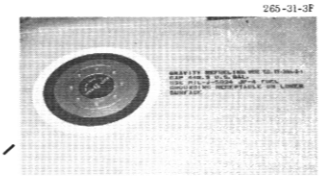
HYDRAULIC RESERVOIR, AIR PRESSURE GAGE AND AIR FILLER VALVE



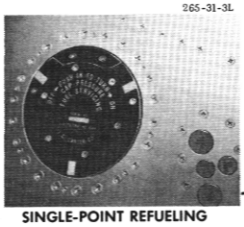
FUSELAGE TANK FUEL FILLER RECEPTACLE



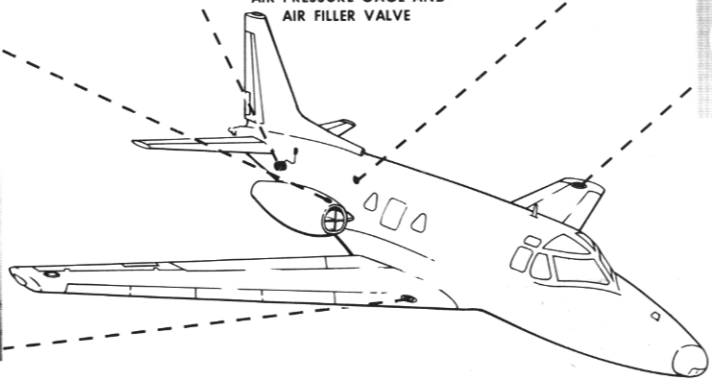
RH ENGINE OIL RECEPTACLE



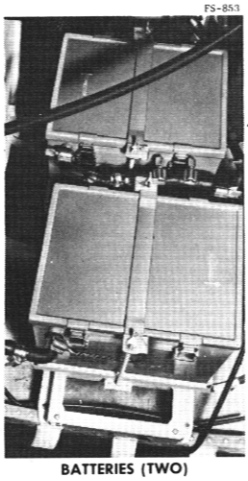
LH WING GRAVITY FUEL FILLER RECEPTACLE



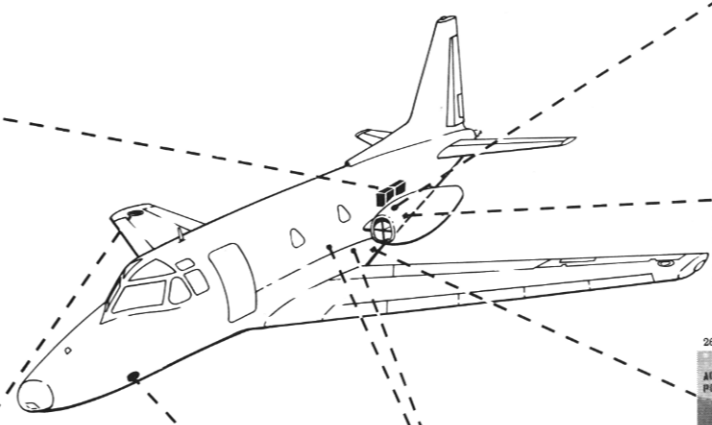
SINGLE-POINT REFUELING RECEPTACLE



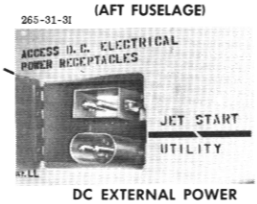
LH ENGINE OIL RECEPTACLE



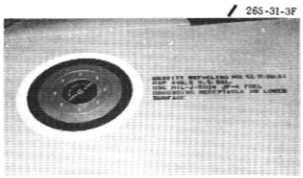
BATTERIES (TWO)



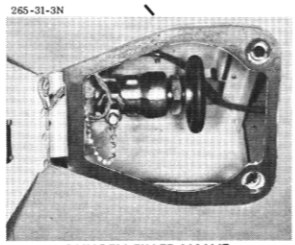
HYDRAULIC SERVICING RECEPTACLES (AFT FUSELAGE)



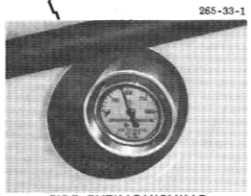
DC EXTERNAL POWER RECEPTACLES



RH WING GRAVITY FUEL FILLER RECEPTACLE



OXYGEN FILLER VALVE



FIRE EXTINGUISHING SYSTEM PRESSURE GAGES

39A-1-00-22J

NORMAL PROCEDURES

SECTION II

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PREPARATION FOR FLIGHT.

FLIGHT RESTRICTIONS.

Refer to Section V for detailed airplane and engine limitations.

FLIGHT PLANNING.

Preflight planning data, such as take-off performance, fuel quantity, cruise data, and other information required to complete the proposed mission, is determined by using the performance data contained in Appendix I. Communication requirements are determined from appropriate flight planning and flight information publications.

TAKE-OFF AND LANDING DATA CARD.

Refer to Parts 2 and 6 of Appendix I for the information necessary to fill out the Take-off and Landing Data Card contained in T.O. 1T-39A-1CL-1, before each flight.

WEIGHT AND BALANCE.

Refer to Section V for weight and balance limitations. For loading information, refer to Weight and Balance Technical Manual, T.O. 1-1B-40. Before each flight, check take-off and anticipated landing gross weight and balance. Ensure that a Form 365F has been completed for weight and balance clearance.

CHECKLIST.

Refer to page iii for additional information on this subject. The checklist will be used in accordance with the applicable USAF directives. Those items followed by "(CP)" will also be performed by the copilot. The terms "climatic" and "as required" indicate equipment operation or settings that will vary depending upon prevailing conditions. The response to these items will be the required control positions.

THRU-FLIGHT INSPECTION.

When the airplane is operated by the same crew on an airline-type operation, the specific inspections preceded by an asterisk (*) must be performed on a thru-flight. However, these are the minimum inspections required, and additional checks may be performed at the discretion of the flight crew in the procedures up to "Starting Engines."

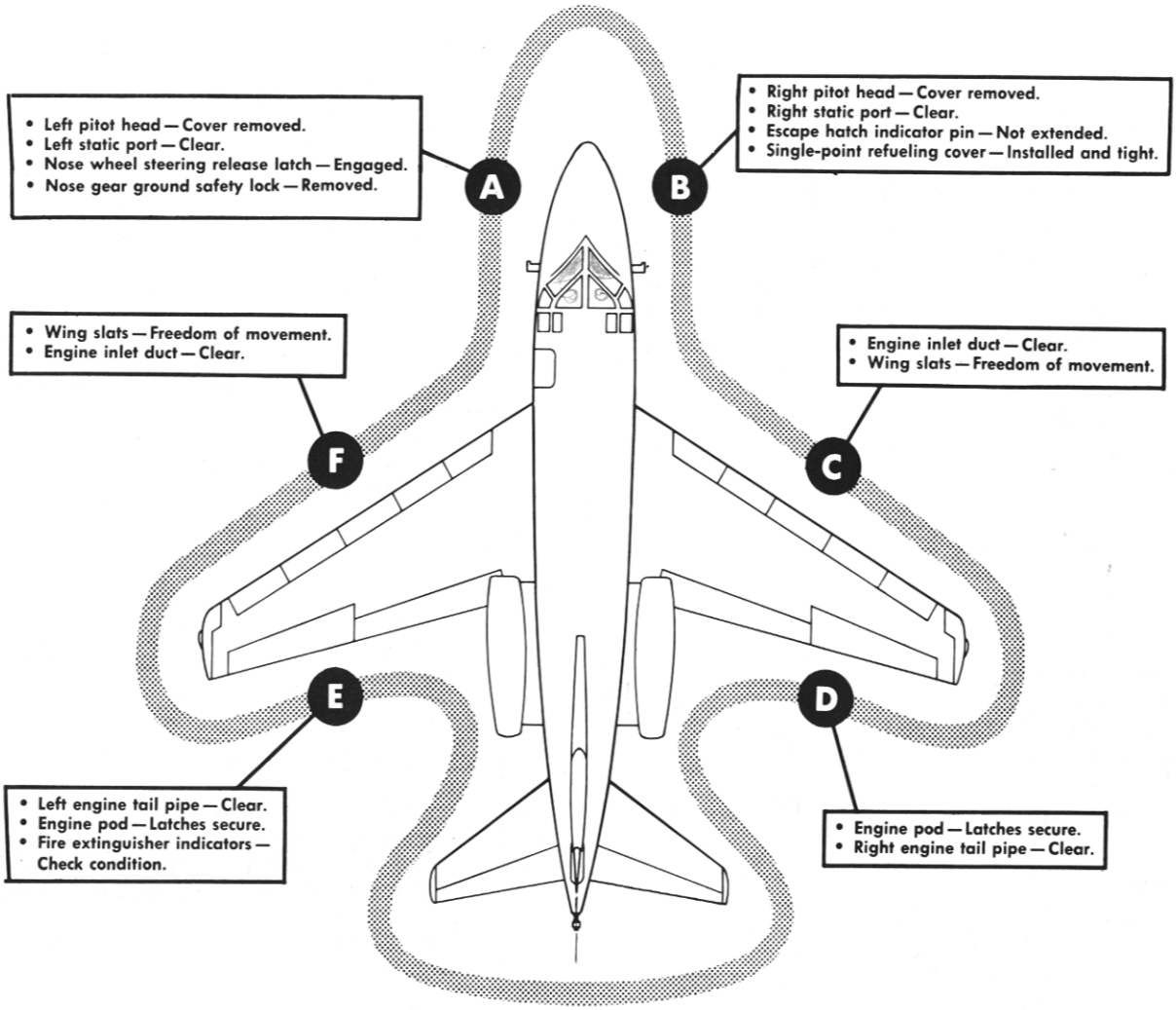
PREFLIGHT CHECK.

BEFORE EXTERIOR INSPECTION.

1. Form 781 - Check.

   Check Form 781 for engineering status, and

EXTERIOR INSPECTION



NOTE

While making the exterior inspection, check all surfaces for general condition; check for fuel, oil, and hydraulic leaks; all ground maintenance locks removed; struts for proper extension and airplane properly chocked.

NOTE

The inspections required by the flight crew are the minimum requirements for a safe flight; however, additional checks may be made at the discretion of the flight crew.

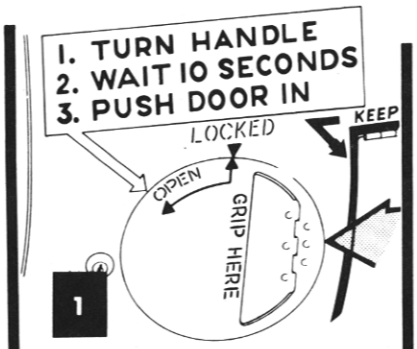
39-1-00-7B

Figure 2-1

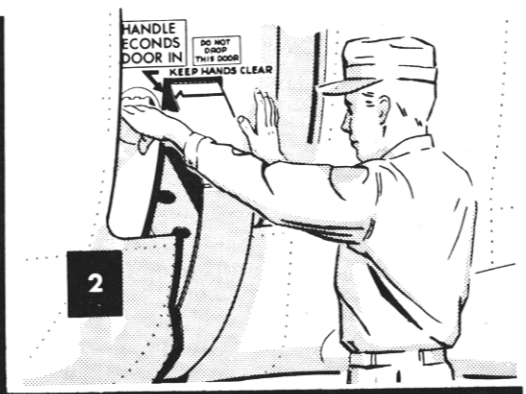
ENTRANCE DOOR OPERATION

CAUTION
When entering the airplane, do not step on the entrance door seal. Damage to the seal can result in faulty operation or loss of cabin pressurization.

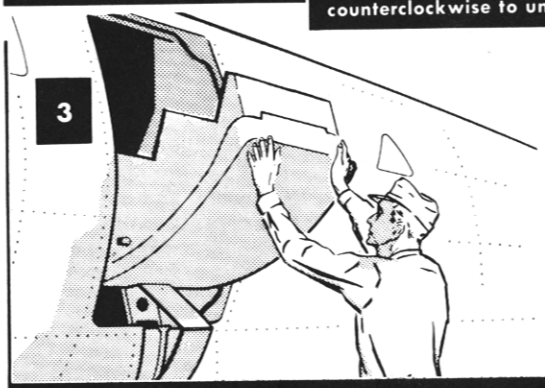
NOTE
For opening the door from the inside and closing from the outside, use reverse sequence.



Turn rotary latch one-quarter turn counterclockwise to unlock door.



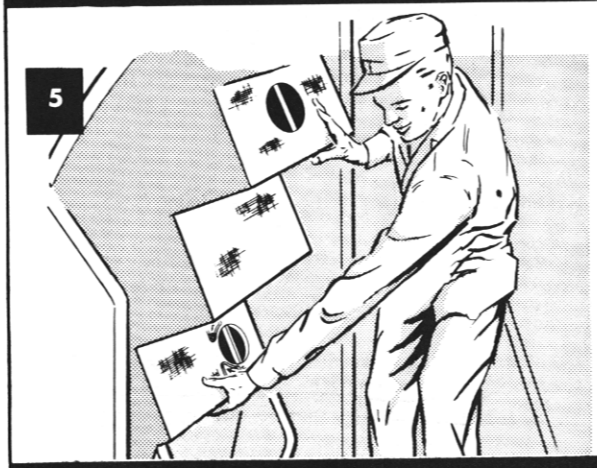
Apply an even pressure on lower section of door. The top of the door will begin a movement outward and start a downward swing.



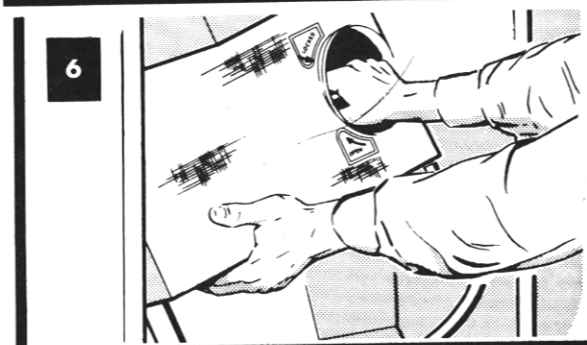
When door rotates and starts downward movement, support door and lower to extended position.

CAUTION
Care should be taken to prevent dropping the door during opening. If door is dropped, damage to the structure can result.

Raise door up and inward. The door will rotate and float inward.



Push door outward, using an even pressure on upper and lower sections of door.



When door is in place, turn rotary locking handle one-quarter turn counterclockwise to lock door.

T-39-1-00-3

Figure 2-2

make sure the airplane has been serviced with the required amounts of fuel, oil, oxygen, and miscellaneous equipment for the intended mission.

2. Check in-flight information publications - As required.

*EXTERIOR INSPECTION.

The flight crew exterior inspection procedures are predicated on the fact that maintenance personnel have completed all postflight and preflight requirements outlined in Sections I and II of the Preflight - Basic Postflight Inspection Work Cards, T.O. 1T-39A-6WC-1PRPO. Duplicate inspections by the flight crew have been eliminated, except for certain items required in the interest of safety. The flight crew inspection is to check the airplane general condition and should follow the path as shown in figure 2-1. If airplane preflight is accomplished at a strange field, refer to detail preflight inspection in Section I of the Preflight - Basic Postflight Inspection Work Cards, T O. 1T-39A-6WC-1PRPO.

NOTE All inspections required during the exterior inspection must be performed during a thru-flight operation. Additional inspections may be made at the discretion of the flight crew.

INTERIOR CHECK.

The following checks are to be performed upon entering the airplane.

Cabin.

*1. Interior - Check loose articles stowed.

When cargo is carried, check that it is properly loaded and secured.

2. Cabin circuit breakers - IN.

3. Cabin speaker switch - As required.

If the cabin is not occupied, the cabin speaker switch may be OFF.

4. Passenger briefing - Completed.

a. Mission

(1) Estimated time en route

(2) Destination

(3) Weather

(4) Altitude and airspeed

b. Parachutes and survival equipment (location, fitting, and use)

c. Oxygen

(1) Oxygen demonstration

(2) Warning horn

d. Crash landing, bail-out, and ditching

e. Escape hatches

f. Seat belts and no smoking signs

g. Interphone

h. Environmental

(1) Speed brake noise

(2) Emergency pressurization duct

(3) Cabin lights

(4) Air outlets (eyeball)

i. Relief containers

5. Cabin emergency escape hatches - Check.

Check that both the ground and in-flight escape hatches are properly latched, secured, and unobstructed, and ground safety pin is removed.

*6. Coat compartment - Check.

Check that loose articles are properly secured, and that the first-aid kit, oxygen walk-around bottle, and emergency ax are installed and secured.

*7. Main entrance door - As required.

8. Hand fire extinguisher - Check.

Check the fire extinguisher at the back of the pilot's seat for condition and pressure (safetied and inspected).

BEFORE STARTING ENGINES.

NOTE When using alternate or emergency fuels, refer to "Alternate and Emergency Fuel Limitations" in Section V.

Starting with the overhead panel, make a check of the cockpit. Items that are duplicated on the panel or consoles are called out only once.

*1. Safety belt and shoulder harness - Secured and adjusted. (CP)

*2. Seat and rudder pedals - Adjust. (CP)

*3. All circuit breakers - Check IN. (CP)

*4. Landing gear handle - DOWN.

*5. Speed brake switch - OUT.

If speed brake is up, move switch to IN.

6. Foot-warmer switches - As required. (CP)†

*7. APU - Connected and ON (JET START).

*8. Battery switch - ON.

NOTE With utility external dc power applied to the airplane, monitor the dc voltmeter. If the voltage exceeds 29.5 volts, leave the battery switch at OFF until external power is disconnected.

*9. DC generator switches - ON.

*10. Inverter switch - STBY.

*11. Electrical master switch - ON.

*12. Radio and instrument master switch - ON.

*13. Caution light test switch - Test.

Check illumination of caution, warning, and indicator lights.

*14. Fasten seat belts and no smoking cabin sign switches - As required.

15. Cockpit speaker switch - As desired.

*16. Emergency light switch - TEST; then ARM.

17. Interior lights - As required. (CP)

Check operation of the following before a flight that will begin or terminate during darkness.

a. Thunderstorm lights

b. Cockpit dome light

c. Cabin lights

d. Console light rheostats

e. Flight instrument light rheostats

f. Radio and engine instrument light rheostat

g. Pedestal and overhead panel light rheostat

18. Anti-icing panel switches - Check following switches OFF.

a. Engine inlet switch

b. Side windshield anti-ice switch

c. Forward windshield generator switches

d. Forward windshield anti-ice switch

e. Fuel heater switch

f. Wing and ram-air inlet switch

19. Pitot heat - Check operation as required; then OFF.

20. Fuel jettison switch - OFF.

*21. Hydraulic pump switch - ON.

When the hydraulic pump is turned on, monitor the hydraulic pressure gages. Check that the pressure builds up smoothly and that the pressure switch cuts out when pressure reaches the upper limit.

22. Auxiliary hydraulic power switch - ON.

*23. Speed brake switch - IN.

Check that both hydraulic pressure gages drop when the speed brake switch is moved and that pressure then builds up smoothly.

24. Auxiliary hydraulic power switch - OFF.

25. Wing flaps - Check operation.

26. Interphone switches - Set. (CP)

27. Oxygen system - Check and set. (CP)

Refer to "Oxygen System Preflight Check - Pilot's " in Section IV.

*28. Oxygen system quantity - Check.

Check oxygen system pressure to determine if the oxygen system has been serviced for the intended mission.

29. Mach-airspeed warning test button - TEST.

*30. Gyrocompass mode switch - As required.

It may be necessary to place the switch at D/G and back to AUTO to obtain initial fast slaving.

*31. Flight director mode selector switch - NAV.

*32. Heading mode selector switch - As required.

†Airplanes changed by T.O. 1T-39-758

33. Landing gear emergency release "T" handle - In.

*34. Landing gear electric reset button - Depress.

35. Static-pressure selector switches - STATIC. (CP)

*36. Gust lock "T" handle - IN.

Caution Ensure that aileron area is clear before gust lock is disengaged.

NOTE In high or gusty winds, it may be desirable to leave the gust lock engaged during engine start.

*37. Flight controls - Check.

Check for proper direction of travel.

38. Trim system - Check; then set. (CP)

a. Trim selector switch - NORMAL.

b. Emergency trim disconnect button - Test.

Depress the emergency trim disconnect button and hold. Check that normal trim is rendered inoperative. Release emergency trim disconnect button.

c. Normal trim system - Check.

Check trim operation by observing the trim tab position indicator.

Warning Take-off should not be attempted unless the trim system operates properly.

d. Take-off trim - Set.

(1) Aileron - Set to 0.

(2) Rudder - Set to 0.

(3) Horizontal stabilizer - Set 2 to 4 degrees.

*39. Parking brake - Set.

Caution When setting the parking brake, if the parking brake "T" handle does not remain extended, repeat the brake setting procedure, applying more pressure on the brake pedals. Do not try to set the parking brake by pulling on the "T" handle harder, as damage to the linkage may occur.

40. Exterior lights - As required.

Check operation of the following before a flight that will begin or terminate during darkness.

a. Ice-check light switch - Check; then OFF.

b. Position light switch - Check.

c. Anticollision light switch - Check; then OFF.

*41. Landing gear position indicator lights - Check.

42. HSI selector switch † - As required.

*43. Fuel quantity - Check.

NOTE If fuel unbalance exceeds 200 pounds, this condition must be corrected before take-off.

*44. UHF antenna selector switch - AUTOMATIC.

*45. Command radio - ON.

All other radios and navigation equipment should be turned OFF during engine start.

*46. Engine fire pull "T" handles - Check IN.

*47. Fire detector system test switch - TEST.

48. Air start switch - OFF.

*49. Throttles - OFF.

*50. Fuel cross-feed and tank selector switch - NORMAL.

51. Landing-taxi light switch - As required.

Check operation of both positions; then OFF before a flight that will begin or terminate during darkness.

Caution To prevent damage to the plastic light cover, do not leave the lights on longer than 2 minutes during static ground testing. During taxiing, use LEFT HAND ONLY position.

52. Nose gear steering selector switch - MAIN.

53. Cabin temperature selector switch - AUTOMATIC.

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† Airplanes changed by T.O. 1T-39A-534 or -544

54. Cabin air selector switch - OFF.

55. Emergency brake "T" handle - IN.

56. IFF - OFF.

STARTING ENGINES.

Whenever practical, engine start should be accomplished on a paved surface to minimize foreign-object damage. If possible, the airplane should be headed into the wind or at right angles to it. (See figure 2-3 for danger areas.)

Engine starts can be made with external or airplane battery power. If external power is used, the power unit must provide a minimum of 24 volts dc and 800 amperes. Start either engine, using the following procedure:

1. Engine master switches - ON.
2. Danger areas - Clear. (CP)
3. Engine starter button - Depress.

   If the starter button pops up, hold it depressed until engine rpm reaches approximately 30 percent.

Caution If 8 percent rpm is not attained in 15 seconds, or there is no indication of oil pressure within 20 seconds, the starter button should be pulled out to stop the starting cycle.

- The starter is limited to 2 minutes of operation in any 20-minute period to prevent damage to the starter.

4. Throttle - IDLE at 8 to 10 percent rpm.
5. Engine instruments - Check. (CP)

   a. Fuel flow gage - Monitor.

      Fuel flow should not exceed 600 pounds per hour, to prevent engine overtemperature.

   b. Exhaust gas temperature gage - Check.

      A rise of exhaust gas temperature should occur within 20 seconds after the throttle is advanced to IDLE. If an exhaust gas temperature rise does not occur within this 20 seconds, or the maximum allowable starting exhaust gas temperature of 525°C is exceeded, return the throttle to OFF and clear the engine.

Caution If a rapid rise in exhaust gas temperature occurs, the throttle should be returned to OFF at 475°C to preclude exceeding the maximum allowable starting exhaust gas temperature.

- If the maximum allowable exhaust gas temperature limits are exceeded, do not attempt another start until engine inspection by maintenance personnel is completed.

   c. Engine tachometer - Check.

      Engine rpm should increase steadily, with the throttle at IDLE, to 41-44 percent. If the engine fails to accelerate to IDLE rpm within one minute after an initial indication of exhaust gas temperature, the throttle should be returned to OFF. If the ignition-on light fails to go out after IDLE rpm is obtained, pull the starter button up to de-energize the starter and ignition.

6. Start second engine. (Repeat steps 3 through 5.)
7. APU - Disconnect.
8. Battery switch - Check ON.

BATTERY START.

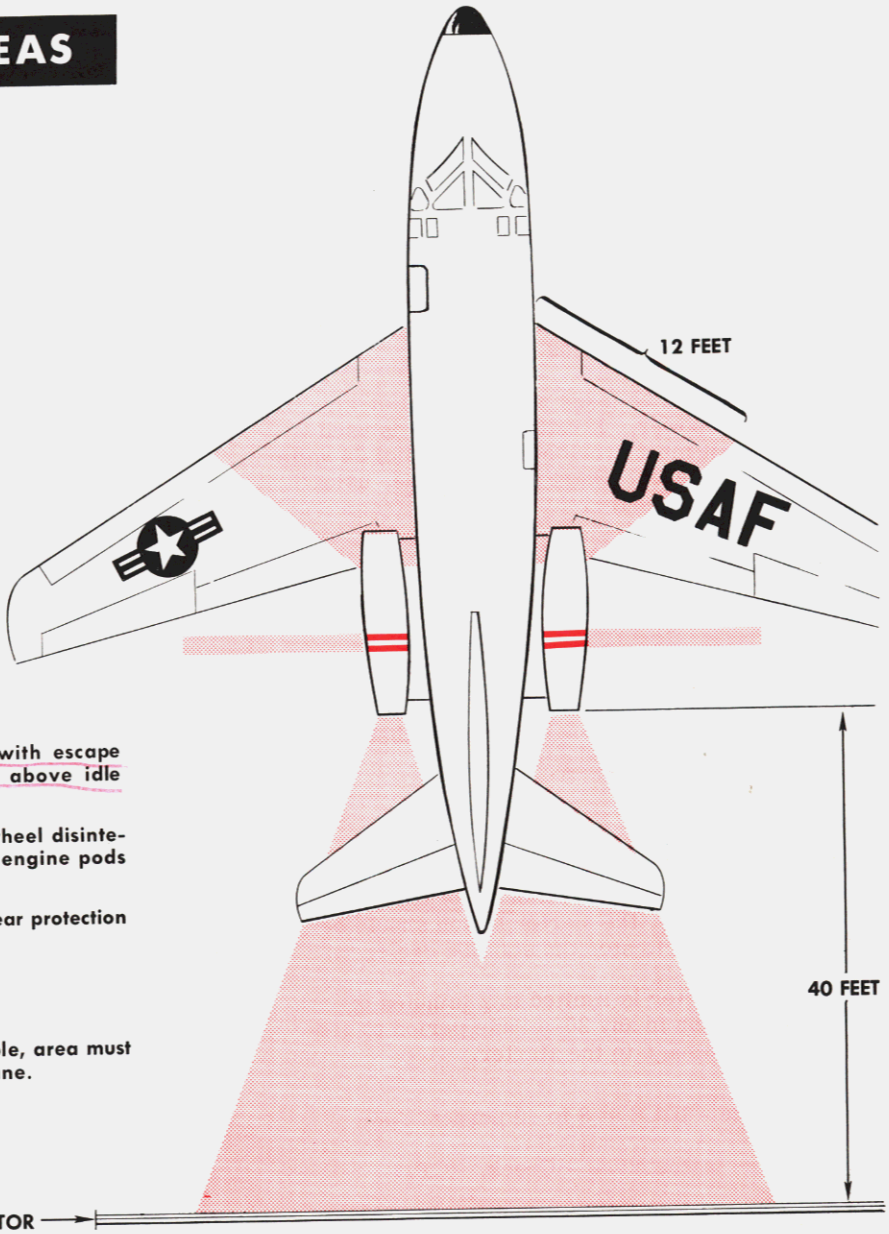
Refer to Section VII for battery start.

CLEARING ENGINE.

When it is necessary to clear an engine of trapped fuel or vapor during ground operation, check that the electrical master, battery, and engine master switches are ON and that the throttles are OFF. Depress the engine starter button and motor the engine for 30 seconds. Then pull the engine starter button and allow the engine to stop rotating before attempting another start.

Caution If it is not desired to motor the engine, allow 2 minutes for fuel to drain before attempting another start. This will prevent possible damage to the engine.

DANGER AREAS



WARNING

- Do not operate right engine with escape hatch removed or left engine above idle with door open.
- Keep clear of engine turbine wheel disintegration planes. Red stripes on engine pods designate this area.
- Ground personnel should wear ear protection during engine operation.

NOTE

- If blast deflector is not available, area must be clear 100 feet aft of airplane.

DISTANCE AFT OF TAIL PIPE—FEET	5	10	15	20	25	30	40	50	60
VELOCITY—MPH	1365	785	505	435	320	265	190	150	115
	305	170	120	95	70	60	35		
TEMPERATURE	650°C (1200°F)	343°C (650°F)	232°C (450°F)	182°C (360°F)	143°C (290°F)	127°C (260°F)	99°C (210°F)	80°C (175°F)	52°C (125°F)
	315°C (600°F)	243°C (470°F)	170°C (340°F)	132°C (270°F)	107°C (225°F)	85°C (185°F)	65°C (150°F)		

Military Thrust in BLACK figures.
Idle Thrust in WHITE figures.

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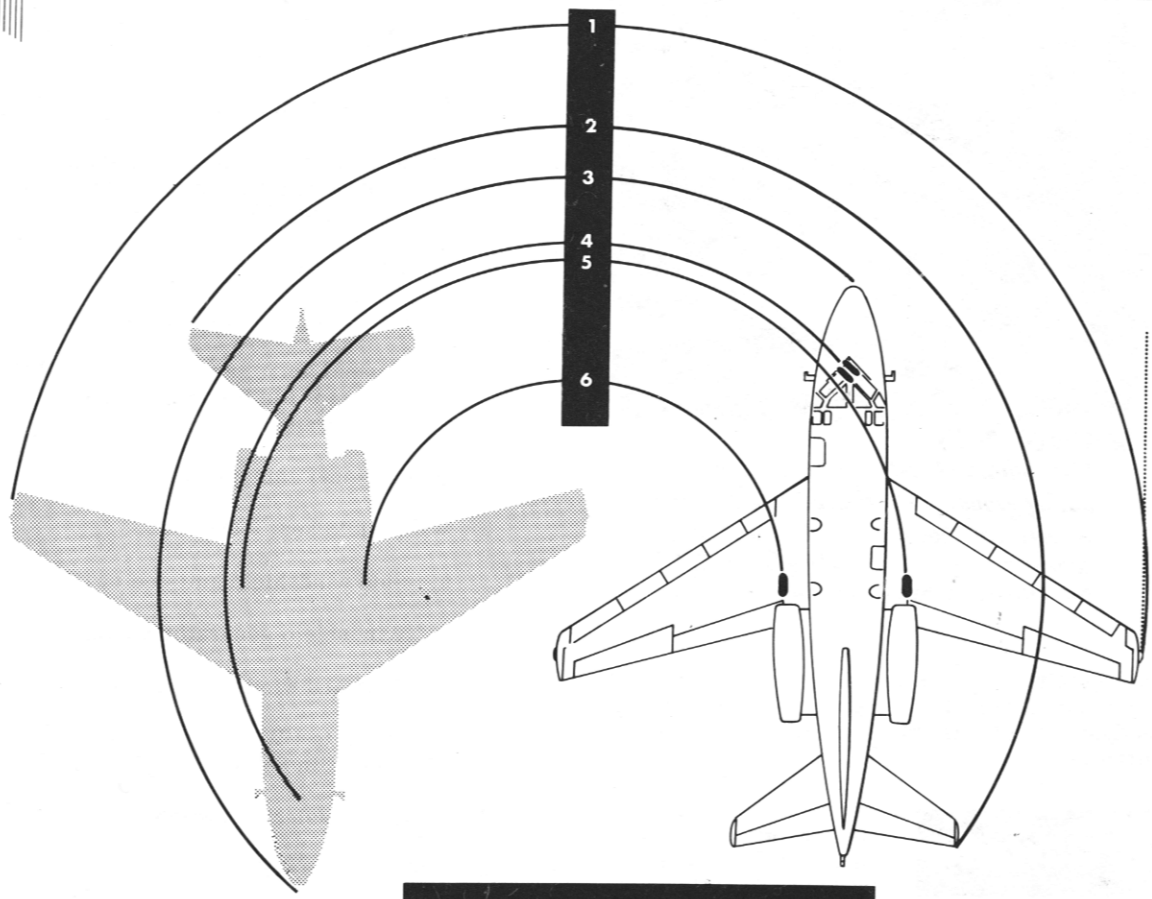
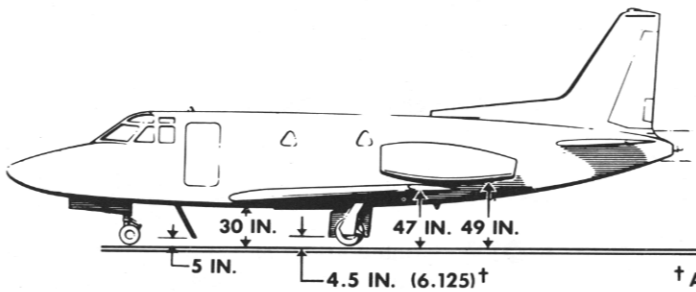
Figure 2-3

MINIMUM TURNING RADIUS AND GROUND CLEARANCE



1. WING TIP LIGHT	43.5 FT
2. HORIZONTAL STABILIZER	35.4 FT
3. NOSE	30.9 FT
4. NOSE GEAR	25.3 FT
5. RIGHT MAIN GEAR	24.3 FT
6. LEFT MAIN GEAR	17.1 FT



NOTE

- **Based on full nose wheel steering and no wheel braking.**
- **For taxiing on unimproved areas, the speed brake should be retracted.**

† Airplanes changed by T.O. 1T-39-760

39-1-00-1D

Figure 2-4

GROUND OPERATION.

WARNING

If a Military Thrust engine run-up is made during ground operation, be sure the main wheels are chocked, and hold the wheel brakes on, because at light gross weights the airplane wheels may slide. T-39A-1-0-9A

No engine warm-up is necessary. As soon as the engine stabilizes at idle rpm with normal gage reading, the throttle may be advanced to Military Thrust.

Warning If a throttle is inadvertently retarded from IDLE to CLOSE, a flame-out of that engine occurs immediately. The throttle must not be readvanced without a complete starting procedure. Otherwise, the resulting flow of unburned fuel into the engine can create a fire hazard.

BEFORE TAXIING.

1. Electrical systems - Check.

   a. DC loadmeters - Check.

NOTE Because of the high recharge capabilities of the batteries, a dc loadmeter reading of 100 percent may be observed after a battery start. These readings are temporary and will decrease after a few minutes of operation.

   b. DC generator switches - RESET, then on, if necessary.

   Normal average dc loadmeter reading, with both generators operating, is 0.3 to 0.6. Loadmeters should normally read within two scale markings of each other.

   c. DC voltmeter - Check.

   Normal dc voltmeter reading will be 27.2 to 29.5 volts.

   d. Stand-by inverter ac voltage - Check.

   Normal ac voltage readings for the stand-by inverter will be 115 (±15) for B- or C-phase and 115 (±6) for A-phase.

   e. Inverter switch - Main.

   f. AC voltage - Check all phases.

   Normal ac voltage readings will be 115 (±15) for B- or C-phase and 115 (±8) for A-phase.

2. Navigational equipment - ON.

3. Windshield heat - ON.

   a. Side windshield anti-ice switch - ON.

   b. Windshield generator switches - ON.

   c. Forward windshield anti-ice switch - ON.

   Refer to "Windshield Overheat Caution Light" in Section IV.

4. Cabin air selector switch - BOTH ENGINES.

5. IFF - STANDBY.

6. Nose wheel steering - Engage.

   When in doubt that nose wheel steering is engaged, hold nose wheel steering button depressed.

7. Caution and warning lights - Check.

   All applicable lights out.

8. Anticollision light switch - ON.

9. Wheel chocks - Removed.

TAXIING.

NOTE Painted areas on ramps, taxiways, and runways are significantly more slippery than nonpainted areas. Painted areas sometimes serve as condensation surfaces, and it is possible to have wet, frosty, or even icy conditions on these areas when

the over-all weather condition is dry. Therefore, use caution when taxiing over these painted surfaces and when lining up for take-off, because of the possibility of skids and loss of control occurring.

Perform the following while taxiing.

1. Hydraulic pressure - Monitor during taxiing. (CP)
2. Normal brakes - Check.
3. Emergency brake – Check (optional on thru flights).
4. Normal brakes - Recheck.
5. Stand-by nose wheel steering - Check.

   a. Nose gear steering selector switch - STANDBY.

   b. Stand-by steering - Check.

   c. Nose gear steering selector switch - MAIN.
6. Nose wheel steering - Engage.

Warning If either main or stand-by nose wheel steering is inoperative, the mission should be aborted. Refer to "Nose Wheel Steering Operation" in Section VII.

7. Flight instruments and navigational equipment - Check. (CP)

NOTE During taxiing, fuel consumption will be approximately 600 pounds per hour per engine.

BEFORE TAKE-OFF.

1. Speed brake switch - IN.
2. Wing flaps - Check UP.
3. Take-off trim - Check.
4. Fuel differential - Check.

   Wing fuel differential should not exceed 200 pounds. Refer to "Fuel System Management" in Section VII.

Warning If the wing fuel unbalance is in excess of 200 pounds, the nose of the airplane will have a tendency to swing toward the heavy wing during take-off.

5. Flight controls - Check for freedom of movement.
6. Cabin air selector switch - Check BOTH ENGINES.
7. Fuel heater - As required.

Caution Do not take off with the fuel heater on. If fuel heater use is necessary before take-off, its operation should be completed before take-off.

8. Crew briefing - Completed.

   a. Normal procedures

   b. Emergency procedures
9. Pilot's sliding window - Closed and locked.
10. IFF/SIF - As required.

LINE-UP.

1. Heading indicator - Check.
2. Throttles - Military Thrust.

   Refer to Part 2 of Appendix I for correct Military Thrust setting for take-off.
3. Engine instruments - Check. (CP)

   Check oil pressure at 40 psi minimum; also make sure exhaust gas temperature does not exceed 677°C during acceleration.

Caution If 677°C is exceeded, shut down engine immediately. Should engine speed exceed 104.2 percent rpm with or without overtemperature condition, shut down immediately.

4. Anti-icing - Climatic.

   Refer to "Operation of Anti-icing System" in Section IV.

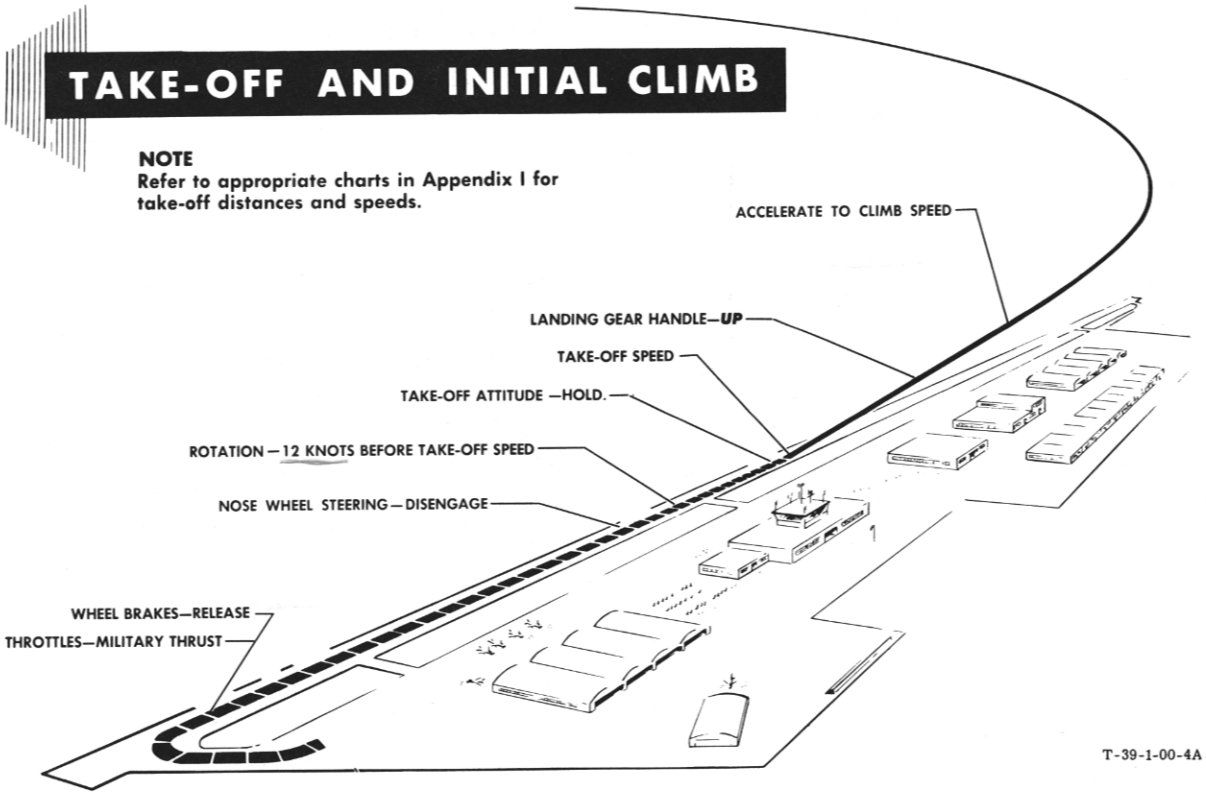


Figure 2-5

TAKE-OFF.

See figure 2-5 for take-off and initial climb.

WARNING

Premature rotation or allowing airspeed to build up above recommended rotation speed increases ground run considerably.

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NORMAL TAKE-OFF.

NOTE The procedures set forth will produce results given in Part 2 of Appendix I. Refer to the appropriate charts for take-off distance and speed.

- Nose wheel steering should be disengaged when the rudder becomes effective at approximately 60 knots IAS.
- Ailerons may be used to effectively aid in directional control on the ground during take-off.
- Avoid using brakes for directional control, as take-off distances will be increased.

With the throttles at Military Thrust, check all engine instruments; then release the wheel brakes. During the take-off run, engine instruments should be monitored. An increase in exhaust total pressure due to ram effect as airspeed increases is normal. Once the proper exhaust total pressure has been set, no further adjustments are necessary during the take-off run unless engine limits are being exceeded. Maintain directional control with nose wheel steering, rudder, and ailerons. At 12 knots below the recommended take-off speed for gross weight and altitude, rotate the airplane (approximately 10 degrees) at such a rate that the airplane will assume the take-off attitude at the

recommended take-off speed. This rotation should be smooth, and overrotation must be avoided. Hold take-off attitude and allow the airplane to fly off the runway. Maintain take-off attitude until climb schedule is reached.

CROSS-WIND TAKE-OFF.

In addition to the procedures used for a normal take-off, during a cross-wind take-off it will be necessary to keep the airplane in a three-point attitude longer than normal. Refer to cross-wind chart in Part 2 of Appendix I to determine the minimum rotation speed to be obtained before aerodynamic steering (rudder control) will be sufficient to maintain directional control. When take-off is started, directional control is maintained with nose wheel steering, rudder, and ailerons. Also be prepared to counteract drift after breaking ground.

AFTER TAKE-OFF.

When the airplane is definitely air-borne, and there is no possibility of settling back onto the runway:

1. Landing gear handle - UP.

CAUTION

- *The landing gear and doors should be completely up and locked before the gear-down limit speed is reached. Refer to Section V for gear-down limit speed.*
- *Check landing gear position indicator lights for up-and-locked indication, and that light in the landing gear handle is out.*

39A-1-0-12A

2. Landing-taxi light switch - OFF.
3. Throttles - Adjust.

   If necessary, adjust the throttles to prevent overboost and to prevent exceeding engine limits.

CLIMB.

Climbs can be made using either Military or Normal Rated Thrust; however, Normal Rated Thrust climbs are recommended for extending engine life. When climbing at Normal Rated Thrust, maintain 240 knots IAS until .64 Mach is intercepted; for Military Thrust climb, maintain 270 knots IAS until .68 Mach in intercepted. Because of changing conditions during a climb, it is necessary to recompute and reset thrust settings periodically. As the climb progresses to higher altitudes, the possibility of overboosting the engines increases and the thrust settings must be monitored more closely using the tabular charts or the J201 com-computer.

NOTE Refer to Section V for engine limitations.

1. Fasten seat belts and no smoking cabin sign switches - As required.

   The fasten seat belts and no smoking signs should be used any time unusual flight conditions are expected or encountered (such as turbulence, smoke or fumes in the airplane, etc).

NOTE Refer to "Center-of-Gravity Limitations" in Section V for limits affecting the operation of the fasten seat belt sign.

2. IFF - Checked.

NOTE As soon after take-off as flight conditions permit, positive operation of the IFF should be established with an Air Traffic Control facility if the route of flight will require an operative IFF. Consult the appropriate flight information publication for IFF/SIF traffic control requirements and procedures.

3. Pressurization system - Check.

   During the climb, check that cabin altitude and pressure differential are following schedule. (Refer to "Air Conditioning and Pressurization System" in Section IV.)

4. Oxygen - As required. (CP)

   Refer to "Oxygen System" in Section IV for operation and use.

5. Altimeter - Set 29.92 in. Hg or as required.

CRUISE.

The maximum P_{t5} for any cruise condition will be the computed Normal Rated Thrust for that Mach, altitude, and temperature. This maximum value will vary with Mach, altitude, and temperature, and should be rechecked periodically during cruise. During level acceleration, P_{t5} may be increased to correspond with the increasing Mach.

After the first 30 minutes of flight and any time the dc loadmeter readings are higher than normal, place the battery switch at OFF and note the change in loadmeter reading. If this change exceeds one-half scale marking on either loadmeter, leave the battery switch at OFF for the remainder of the flight. In cases where the battery switch is turned off, make an entry on the Form 781 for a maintenance check of batteries. DC loadmeter readings during the first 30 minutes of flight are not conclusive, as low-charge batteries will cause higher than normal readings until charged.

Refer to Section IV for fuel heater operation.

Caution To reduce the possibility of flame-out during flight above 35,000 feet, maintain at least 180 knots IAS and adjust throttles one at a time, avoiding rapid movements.

NOTE For cruise data, refer to Part 4 of Appendix I.

FLIGHT CHARACTERISTICS.

Refer to Section VI for information regarding flight characteristics.

DESCENT.

Normally, the rate of descent is determined by altitude, distance from the field, and comfort of the passengers.

NOTE Refer to "Descents" in Part 5 of Appendix I.

- Adjust engine power during descent to provide adequate temperature control. Refer to "Air Conditioning and Pressurization System" in Section IV.

1. IFF - Checked.

   Within one hour before estimated time of landing, a positive IFF check should be made with an Air Traffic Control facility.

2. Altimeter - Set to current altimeter setting. (CP)

3. Anti-icing - Climatic.

RAPID DESCENT.

Circumstances may arise which require a rapid descent in the shortest time possible. If this occurs, move throttles to IDLE, extend the speed brake, and maintain limit airspeed or Mach during the descent.

NOTE Refer to Section V and see figure 5-1 for airspeed and Mach limits.

BEFORE LANDING.

During the final phase of the descent and the approach to the field, make the following checks:

1. Fasten seat belts and no smoking cabin sign switches - As required.

2. Fuel quantity - Check. (CP)

   If the low fuel level caution light is on, move fuel cross-feed and tank selector switch to CROSS-FEED for landing. Wing fuel differential should not exceed 200 pounds.

3. Fuel heater - As required.

4. Landing data - Check. (CP)

5. Landing gear handle - DOWN.

Caution Before moving the landing gear handle, press and hold the release safety latch or button. Hold the latch or button depressed until the handle is full down.

Check for gear-down-and-locked indication.

NOTE If after a normal waiting period, a safe gear-down indication is not observed, press the landing gear downlock electric reset button † to relieve the hydraulic pressure on the spring-loaded downlock pins. On airplanes not equipped with the downlock electric reset, the same function may be accomplished by pulling the landing gear emergency release "T" handle (approximately 2 inches). The landing gear electric reset button should be pressed after the "T" handle is returned to the stowed position. If a safe gear-down indication does not occur immediately, refer to landing gear emergency lowering procedure in Section III.

---

† AF62-4448 and all later airplanes

6. Wing flap handle - DOWN.

   Wing flaps may be delayed when flying an extended pattern.

7. Hydraulic system pressure - Monitor. (CP)

LANDING.

NORMAL LANDING TECHNIQUE.

See figure 2-6 for normal traffic entry and pattern procedures.

NOTE The use of the speed brake and the amount of flaps that can be used are optional; however, it is recommended that full flaps be used to decrease the landing speed. Refer to Part 6 of Appendix I for final approach airspeeds and landing distances.

Fly a smooth, power-on final approach, maintaining a rate of descent between 500 and 1000 fpm. Use smooth control pressures during the flare, touching down on the main wheels first.

NOTE Do not attempt a full-stall landing, as the tail could drag the ground at high angles of attack.

After touchdown, gently lower the nose wheels to the runway, raise wing flaps, and check the wheel brakes. Use rudder for directional control and, when required, nose wheel steering. Monitor hydraulic pressure.

Caution Do not engage nose wheel steering during landing roll unless rudder pedal position is at or near neutral.

Aerodynamic braking is relatively ineffective, but may be used where long runways do not require normal braking. It is best accomplished by holding the nose of the airplane high with the flaps down and the speed brake extended. Lower the nose slowly while there is still elevator control, to prevent slamming the nose on the runway and possibly damaging the nose gear, wheel, or tires.

HEAVY-WEIGHT LANDING.

For heavy-weight landings, increase approach and touchdown speeds as listed in Part 6 of Appendix I.

Caution To avoid excessive sink rates, maintain proper approach and touchdown speeds for weight and configuration. Partial power should be maintained until touchdown.

MINIMUM-ROLL LANDING.

Caution During a minimum-roll landing approach, airspeed and power control must be maintained to avoid excessive sink rates.

To achieve a minimum-roll landing, fly final approach at 5 knots IAS less than the recommended approach speed for weight and configuration, with the speed brake out, touching down as near the end of the runway as possible.

Retard throttles to IDLE as soon as main gear touchdown is felt, lower nose wheel, retract flaps immediately, start braking action, and engage nose wheel steering. If desired, one engine may be shut down to reduce engine thrust and aid in decreasing the landing roll.

Caution Optimum braking can be achieved by applying a continuously increasing force on the pedals as the airplane slows down, attempting to remain just short of skidding.

SLIPPERY-RUNWAY LANDING.

The approach and braking technique for a slippery-runway landing is the same as for a minimum-roll landing. The braking effectiveness varies greatly on slippery runways; therefore, the conditions of the runway must be determined by ground personnel and the pilot advised accordingly. Using the reported runway condition reading, determine total ground roll distance. (Refer to Part 6 of Appendix I.) Strict adherence to the correct final approach airspeed is essential. Aerodynamic braking is relatively ineffective, particularly during cold temperatures when idle thrust is high. Braking should be commenced as soon as the nose wheel is on the runway. A combination of rudder, ailerons, brakes, and nose wheel steering may be required for directional control. If stopping distance is critical, the landing roll can be substantially reduced by shutting down one or both engines after touchdown.

HYDROPLANING.

Hydroplaning, in its meaning here, is a condition where the tires of the airplane are separated from the runway surface by a fluid. Under conditions of total hydroplaning, the hydrodynamic pressures between the tire and runway lift the tires off the runway to extent that wheel rotation slows and actually stops. The major factors in determining

LANDING PATTERNS (TYPICAL)

NOTE
Refer to appropriate charts in Appendix I for final approach and touchdown speeds.

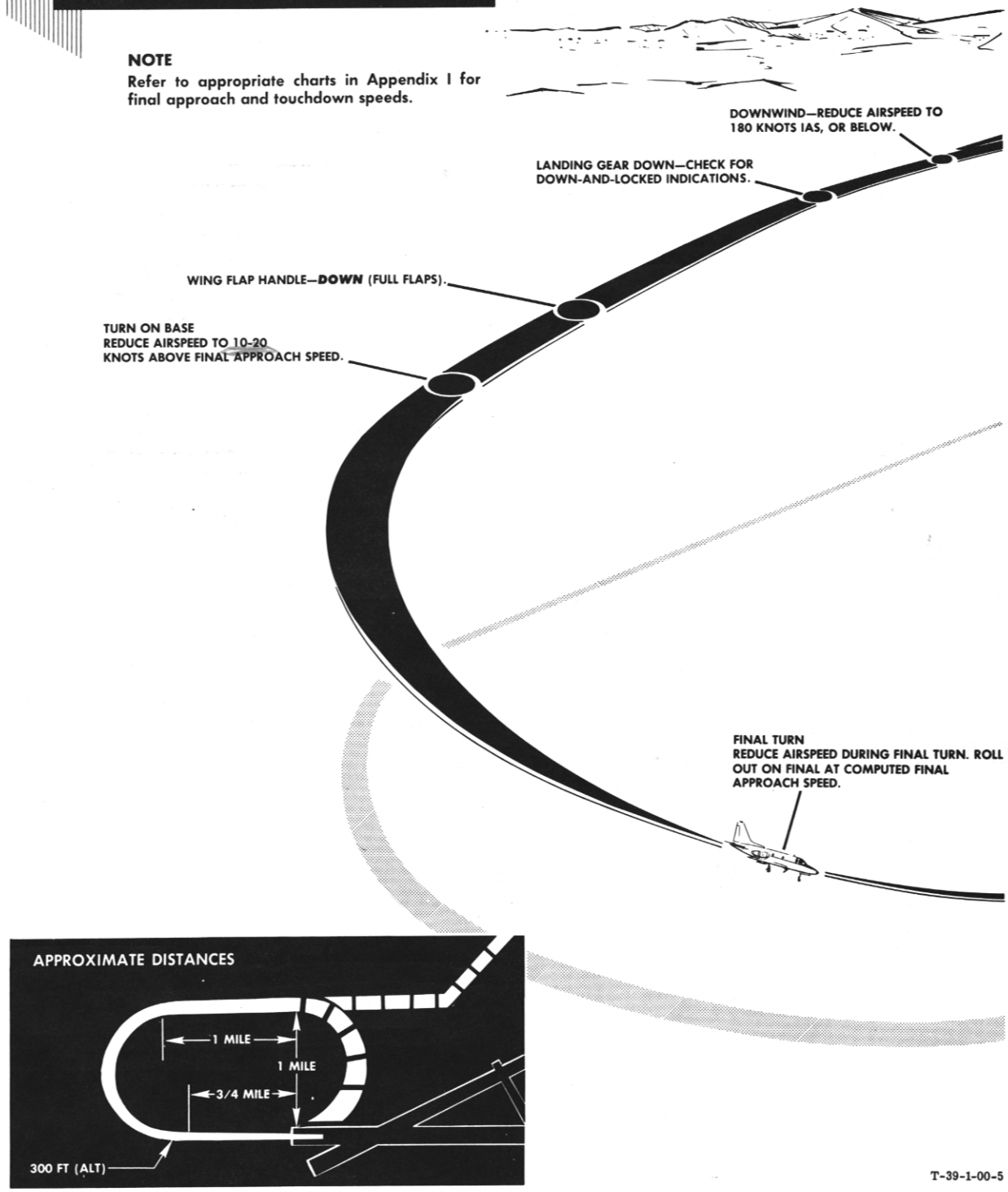
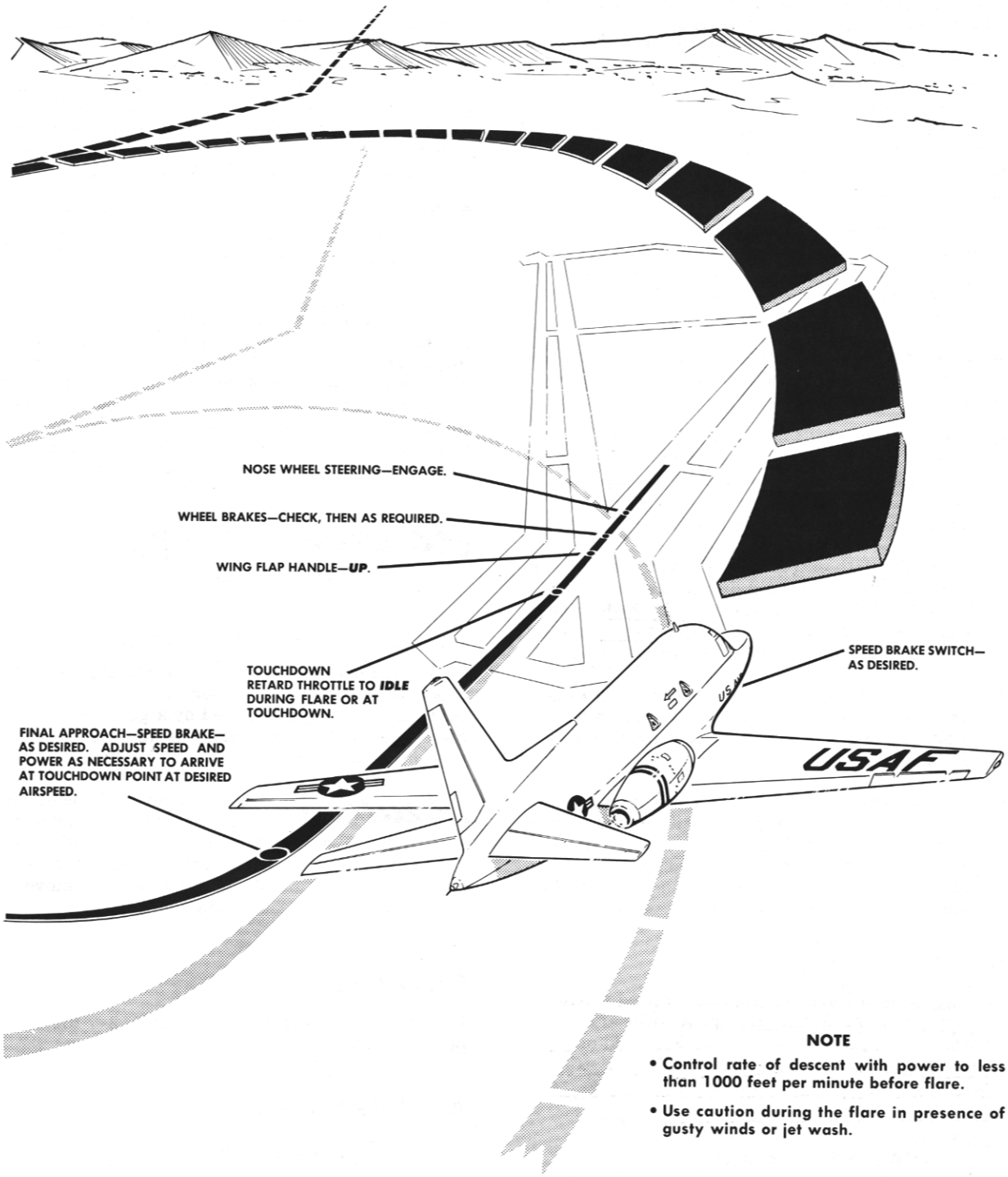


Figure 2-6



NOTE

- Control rate of descent with power to less than 1000 feet per minute before flare.
- Use caution during the flare in presence of gusty winds or jet wash.

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when an airplane will hydroplane are forward speed and tire pressure. To a lesser degree, the airplane gross weight, depth of water on the surface, texture of the surface, type of tire used, and condition of the tires influence the total hydroplaning speed. Total hydroplaning in this airplane with recommended tire pressures and 1/8 to 1/4 inch of water or slush on the runway can be expected at approximately 78 knots IAS for the nose gear tires and 116 knots IAS for the main gear tires. Hydroplaning is aggravated in landings with a tail-wind component, because of increased ground speeds. Partial hydroplaning occurs to varying degrees below these speeds.

Whenever an airplane is subjected to hydroplaning to any degree, directional control becomes difficult. Under total hydroplaning conditions, nose wheel steering is ineffective and wheel braking is nonexistent.

The adverse effects of hydroplaning can be minimized by consideration and application of the following:

1. Smooth tires tend to hydroplane with as little as 1/10 inch of water and possibly at slightly lower speeds. Ribbed tires tend to release hydrodynamic pressures and will not hydroplane until water depth is 2/10 to 3/10 inch.

2. Take-offs with extreme cross-winds and water-covered runways should be made with caution. When lift-off speed is greater than hydroplaning speed, the airplane is subjected to the effects of the cross-wind while hydroplaning.

3. An aborted take-off on a wet runway initiated at or near hydroplaning speed will require considerably more runway than one aborted on a dry runway.

4. For landings, reduce gross weight below 15,000 pounds and effect a positive, touchdown early to utilize available runway. Lower nose wheels to runway before applying brakes. Maintain directional control with rudder to below nose gear tire hydroplaning speed.

LANDING IN TURBULENCE.

For landing in turbulence, approach speed should be increased as needed to provide additional control margin. With a known gust factor, add one-half the gust factor to approach speed. For example, with a wind of 10 knots and gusts to 20 knots, add 5 knots to approach speed.

CROSS-WIND LANDING.

In addition to the procedures used for a normal landing, the following should be accomplished.

NOTE Before landing, refer to the cross-wind chart, in Part 2 of Appendix I, for the head-wind component in order to compute the landing distance, and the cross-wind component to determine the minimum speed for nose wheel touchdown.

In a strong cross-wind, the approach speed should be increased and partial or no flaps used. On final approach, crab or drop a wing to keep lined up with the runway. However, if crabbing, the airplane must be aligned with the runway just before touchdown. At touchdown, lower nose wheels to runway as soon as possible, maintaining aileron into the wind throughout the landing roll.

NOTE With the nose wheel off the ground, the airplane tends to weathervane into the wind; with the nose wheel on the ground, the airplane tends to turn downwind.

After the nose wheels are on the runway, the airplane will assume greater directional stability, particularly if kept on the upwind side of the runway crown. Because of the close inboard location of the engines, practically no advantage is gained by using asymmetrical power settings during cross-wind landings. A combination of rudder, aileron, brakes, and nose wheel steering should be used for directional control.

Caution Do not engage nose wheel steering until rudder position is at or near neutral.

TOUCH-AND-GO LANDING.

Touch-and-go landing may be practiced, using the procedures outlined for a normal landing to the point of touchdown, followed by a go-around. Nose wheels should normally be kept off the runway throughout the touch-and-go landing.

Caution Rapid throttle advances during touch-and-go landings and go-arounds may produce undesirable yaw as a result of uneven engine acceleration. A smooth, positive throttle movement will reduce this condition to a minimum.

GO-AROUND.

For making a go-around, see figure 2-7 for complete procedure.

AFTER LANDING.

AFTER CLEARING RUNWAY.

1. Speed brake - As required.

   For taxiing on unimproved areas or under adverse weather conditions, move the speed brake in.

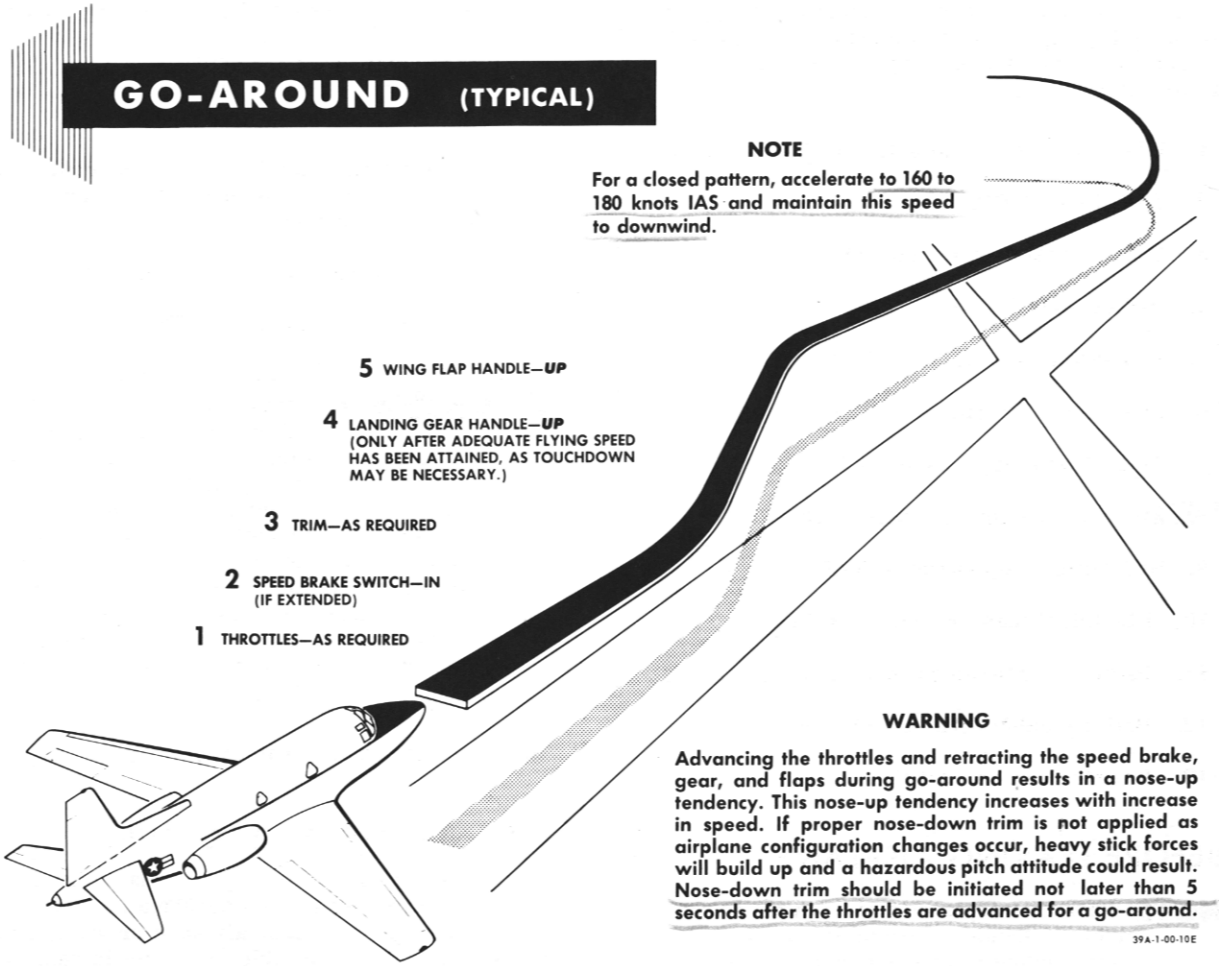

Figure 2-7

2. Anti-icing switches - All OFF.
3. IFF - OFF.

   Turn IFF OFF as soon after landing as possible. This will eliminate signals from taxiing or parked airplanes which would otherwise block the controller's scope and interfere with the control of air-borne airplanes.

4. Landing-taxi light switch - As required.
5. Navigational equipment - OFF.
6. Retrim for take-off.
7. Hydraulic pressure - Monitor. (CP)

NOTE It is permissible to shut down one engine during taxiing to reduce braking required and extend brake and tire usage.

Caution If one engine is shut down for taxiing, the standby inverter should be selected to prevent overheating of equipment due to loss of ground blower.

JUST BEFORE PARKING.

1. Speed brake switch - OUT.
2. Cabin air selector switch - OFF.

WARNING Lw 15-14 31MAR67

ENGINE SHUTDOWN.

NOTE Check that the engines decelerate freely, and listen for any unusual engine noises during shutdown.

The engines should be operated for about 3 minutes at reduced thrust (70 percent rpm or below) before

shutdown to stabilize engine temperatures. Operation during approach and taxi can be considered as reduced thrust time. At parking area, proceed as follows:

1. Wheel brakes - Hold until chocks are in place.
2. Throttles - OFF.
3. Engine master switches - OFF.
4. Radios - OFF.
5. Foot-warmer switches - OFF. (CP)†
6. Gust lock "T" handle - Engage.
7. Anticollision light switch - OFF.
8. Emergency lighting switch - DISARM.
9. Hydraulic pump switch - OFF.
10. Electrical master switch - OFF.
11. Radio and instrument master switch - OFF.
12. Battery and generator switches - OFF.
13. Inverter switch - OFF.

BEFORE LEAVING AIRPLANE.

NOTE When the airplane is to be parked overnight, it should, if possible, be refueled after landing to preclude wing fuel seepage from high to low wing.

†Airplanes changed by T.O. 1T-39-758

Make the following checks before leaving airplane:

1. Light switches - Check OFF.
2. IFF - Classified codes removed.

   If classified codes have been inserted, they must be removed or properly protected to prevent compromise.

3. In-flight escape hatch safety pin - IN.
4. Form 781 - Complete.

NOTE SEE OPS SUP. 1520 31 JUL 68

Caution Make appropriate entries in Form 781 covering any limits in the Flight Manual that have been exceeded during the flight. Entries must also be made if any engine compressor stalls were encountered, or when, in the pilot's judgment, the airplane has been exposed to unusual or excessive operations such as hard landings, excessive braking action during aborted take-offs, long and fast landings, long taxi runs at high speeds, etc.

5. Nose gear ground safety lock - Installed.

STRANGE-FIELD PROCEDURE.

If mission requirements require a landing at a strange field where ground personnel are not completely familiar with your airplane or where ground personnel are not available, the pilot is responsible for the condition of the airplane. The postflight and preflight inspections must be accomplished in accordance with Sections I and II of the Preflight - Basic Postflight Inspection Work Cards, T.O. 1T-39A-6WC-1PRPO.

EMERGENCY PROCEDURES

SECTION III

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INTRODUCTION.

The procedures contained in this section are considered the best for coping with the various emergencies that may be encountered during operation of this airplane. Only single failures are considered; however, each failure presents a different problem. The procedures presented in **BOLDFACE TYPE** are the procedures that must be committed to memory, as the time factor in an emergency of this type will not allow use of a checklist except as a cleanup reference. A pilot with a thorough knowledge of these procedures will be better able to cope with the problems encountered. Even though the procedures are considered the best possible, sound judgment must be used when multiple emergencies, adverse weather, terrain clearance, etc, are encountered.

CAUTION AND WARNING LIGHTS—INITIAL ACTION.

Figure 3-1 is a ready-reference list of all caution and warning lights, and a condensed list of initial steps to be performed in an attempt to isolate the cause of light illumination. Each step is followed by a reference to the subject and section where detailed information and procedures may be found.

EMERGENCY SIGNALS.

If an emergency arises, the crew and passengers should be kept informed and the nearest ground station informed as to the type of emergency and planned action. If the emergency requires some action by the passengers, the pilot will notify them of the emergency and the action required over the interphone. In case the interphone is inoperative or time is critical, the alarm bell will be utilized as the signal. The emergency alarm bell signals are as follows:

- 6 short rings - Prepare for ditching or forced landing.
- 1 long sustained ring - Brace for ditching or forced landing.
- 3 short rings - Prepare for bail-out.
- 1 long sustained ring - Bail out.

With the emergency escape hatch open, it is possible that the alarm bell will not be heard.

ENGINE FAILURE.

Failures of jet engines are, as a rule, the result of improper fuel scheduling caused by malfunction of the fuel control system or incorrect operating

CAUTION AND WARNING LIGHTS— INITIAL ACTION

LIGHT	ACTION AND PROCEDURE REFERENCE	LIGHT	ACTION AND PROCEDURE REFERENCE
HYD PRESS/PWR OFF	Hydraulic pressure gages—Check. "Hydraulic Power System Failure" in Section III.	MAIN STEER FAIL	"Main Steering System Failure Caution Light" in Section I.
LH OIL OHEAT	Pressure beyond safe limits—Shut down engine. Pressure within safe limits—Continue operation. "Engine Oil Overheat" in Section III.	RH OIL OHEAT	Pressure beyond safe limits—Shut down engine. Pressure within safe limits—Continue operation. "Engine Oil Overheat" in Section III.
AFT FUS OHEAT	Cabin air selector switch— EMER PRESS. "Loss of Pressurization" in Section IV.	PRESS DUCT FAIL	Cabin air selector switch— EMER PRESS. "Loss of Pressurization" in Section IV.
CABIN PRESS FAIL	Cabin air selector switch— BOTH ENG. "Loss of Pressurization" in Section IV.	CABIN AIR OHEAT	Cabin air temperature switch— MANUAL COLD. "Cabin Air Overheat Caution Light" in Section IV.
DOOR OPEN	Fasten seat belt sign— ON. "Door-open-in-flight Emergency" in Section III.	WINDSHIELD OHEAT	Windshield anti-ice system failure chart. in Section IV.
ICING CONDITION †	Engine inlet anti-icing switch— ON. "Engine Inlet Anti-icing Switch" in Section IV.	SPEED BRAKE OPEN	Speed brake switch— IN. "Speed Brake Caution Light" in Section I.
LH ENG DE-ICE FAIL	Increase compressor bleed air (advance throttle). No corrective action for malfunctioning valve. "Engine Anti-icing Failure lights" in Section IV.	RH ENG DE-ICE FAIL	Increase compressor bleed air (advance throttle). No corrective action for malfunctioning valve. "Engine Anti-icing Failure lights" in Section IV.
FUEL SHUTOFF FAIL	No immediate action required. "Fuel Shutoff Fail Caution Light" in Section I.	MAIN INVERTER FAIL	Inverter switch— STANDBY. "Inverter Failure" in Section III.
FUEL FILTER BLOCK	Fuel heater switch— ON. "Operation of Fuel Filter Deicing System" in Section IV.	FUEL JETTISON OPEN	Fuel jettison switch— OFF. Refer to "Automatic Fuel Jettison Failure" in Section III.
LH FUEL HEAT ON	Fuel heater switch— OFF. "Operation of Fuel Filter Deicing System" in Section IV.	RH FUEL HEAT ON	Fuel heater switch— OFF. "Operation of Fuel Filter Deicing System in Section IV.
FUEL TANK X-FD FAIL	Fuel cross-feed and tank selector switch— NORM. "Fuel Tank Cross-Feed Fail Caution Light" in Section I.	FUEL PUMP X-FD FAIL	Fuel cross-feed and tank selector switch— NORM. "Fuel Pump Cross-feed Fail Caution Light" in Section I.
LH FUEL PRESS LOW	Fuel cross-feed and tank selector switch— X-FEED. "Airplane Fuel System Failure" in Section III.	RH FUEL PRESS LOW	Fuel cross-feed and tank selector switch— X-FEED. "Airplane Fuel System Failure" in Section III.
LOW FUEL LEVEL	Fuel quantity gages—Check. "Low Fuel Level Caution Light" in Section I.	OIL PRESS LOW	Oil pressure 35 to 40 psi—Reduce thrust. Oil pressure below 35 psi—Shut down engine. "Engine Oil System Failure" in Section III.
LH AC GEN OHEAT	Affected ac generator— OFF. "Forward Windshield AC Generator Switches" in Section IV.	RH AC GEN OHEAT	Affected ac generator— OFF. "Forward Windshield AC Generator Switches" in Section IV.
LH DC GEN OHEAT †	Affected dc generator— OFF. "DC Generator Overheat" in Section III.	RH DC GEN OHEAT †	Affected dc generator— OFF. "DC Generator Overheat" in Section III.
LH AC GEN OFF	"Forward Windshield AC Generator Switches" in Section IV.	DC GEN OFF	DC loadmeters—Check. "DC Generator Failure" in Section III.
AC INST POWER OFF	Inverter switch— STANDBY. "Inverter Switch" in Section I.	RH AC GEN OFF	"Forward Windshield AC Generator Switches" in Section IV.

†Some airplanes. (Refer to applicable text.) NEW

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Figure 3-1

technique during critical flight conditions. If engine failure is due to improper operating technique, an air start can usually be made to restore engine operation. In case of obvious mechanical failure, an air start should not be attempted. Except for higher rates of descent, the airplane has normal flight characteristics with both engines dead. The single-engine handling characteristics are excellent. Unbalanced engine thrust does have a slight tendency to yaw the airplane toward the dead engine which must be neutralized with aileron and rudder, or trim. The airplane can be trimmed hands-off, and all normal flight maneuvers may be performed as long as the recommended single-engine airspeed is maintained. (See figure 3-3.)

ABORT.

Before take-off, the pilot should determine the applicable speeds and take-off distances in case of fire or failure of one engine. (Refer to Part 2 of Appendix I.)

Decision Speed for Abort.

The abort procedures, as applied to this airplane only, are based on the use of decision speed. This decision speed is either refusal speed or rotation speed, whichever is less. If the runway length available is approximately the critical field length, the computed refusal speed will be the lesser value and will determine the abort decision. However, if the runway length available is much greater than the critical field length, the airplane rotation speed becomes the decision speed since it is less than the refusal speed. In using decision speed, only two cases are considered: (1) the take-off should be aborted if a failure or emergency occurs before decision speed, and (2) the take-off should be continued if the failure or emergency occurs after decision speed. (Refer to Part 2 of Appendix I.)

Engine Failure/Fire Before Decision Speed.

If either engine fails or fire occurs before reaching the decision speed, the take-off should be aborted.

Abort Procedure.

The abort procedure is basically the same for any take-off emergency. Depending upon the severity of the situation, do as many of the following as necessary.

1. THROTTLES — IDLE (OFF FOR FIRE).

Steps 2 through 6 will be performed, if necessary.

2. WHEEL BRAKES—AS REQUIRED.
3. FIRE PULL "T" HANDLE—PULL (IF NECESSARY).
4. FIRE EXTINGUISHER SWITCH — EXT NO. 1 (IF NECESSARY).

   If fire warning still continues or there are other indications of fire, use extinguisher No. 2.

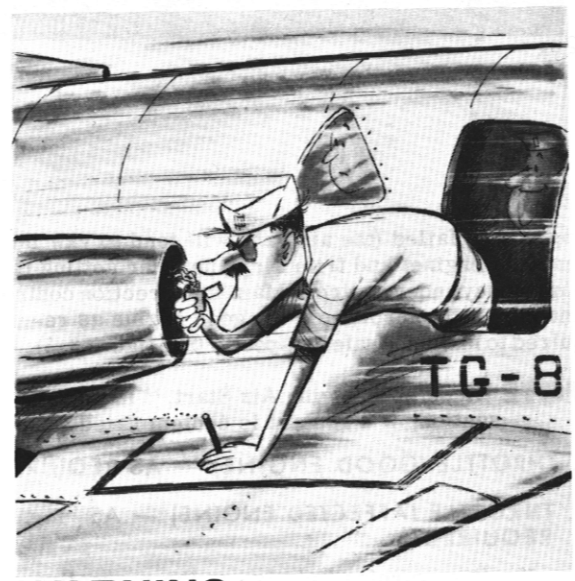
5. Engine master switch(es) - OFF (after airplane stops).
6. Electrical master switch - OFF.

NOTE Nose wheel steering and hydraulic pump power are not available when the electrical master switch is OFF. Be prepared to use emergency brakes, if needed.

Engine Failure/Fire After Decision Speed.

NOTE For single-engine climb speed, refer to Part 2 of Appendix I.

If the decision speed has been reached or passed, continue take-off at computed take-off speed. When the airplane is safely air-borne, move the landing gear handle to UP and accelerate to best single-engine climb speed while maintaining safe altitude. When the engine fails, determine which



WARNING

Check and positively determine which engine has failed before retarding the throttle for the failed engine to OFF.

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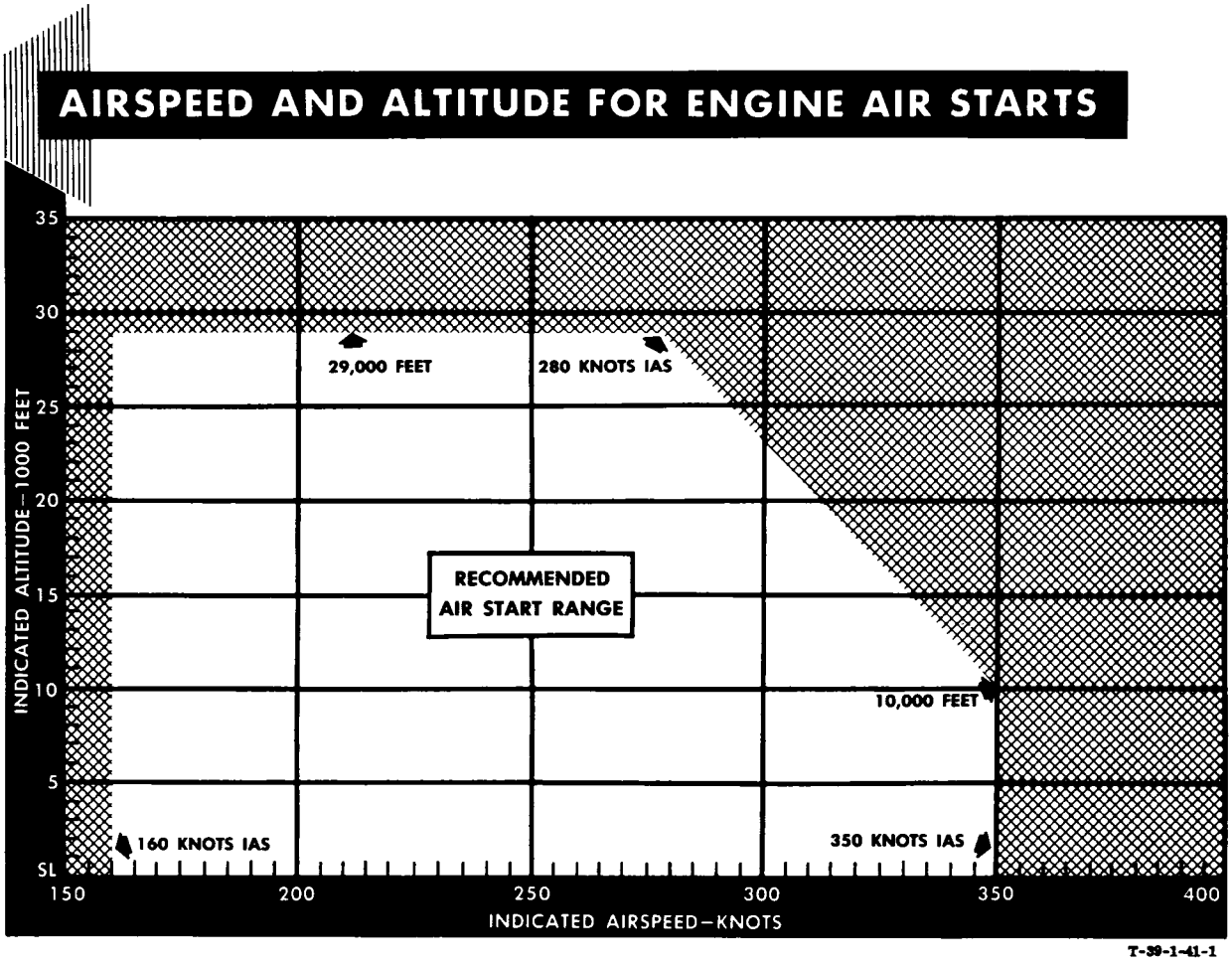

Figure 3-2

engine has failed (the airplane will tend to yaw into the dead engine) and trim airplane after getting the emergency under control. Maintain direction control and adjust the throttle on the good engine as required to maintain safe airspeed. (See figure 3-3).

NOTE Refer to "Engine Air Start," in this section, if a restart is contemplated.

1. **THROTTLE (GOOD ENGINE) — AS REQUIRED.**

2. **THROTTLE (AFFECTED ENGINE) — AS REQUIRED.**

   If a fire-warning light is on, the respective throttle should be immediately moved to IDLE. If the fire-warning light goes out within 10 seconds, continue operation at reduced thrust. If the warning light stays on, continue with step 4. If a partial power loss is experienced on one engine, it may be desirable to leave the throttle of the affected engine as is and continue with single-engine operations.

3. Landing gear handle - UP, when safely air-borne.

   If flaps and speed brake are extended, as during a go-around, they should be retracted.

Steps 4 through 10 will be performed, if necessary.

4. Throttle (affected engine) - OFF.

5. Fire pull "T" handle - PULL.

6. Fire extinguisher switch - EXT NO. 1.

7. Engine master switch - OFF.

8. If fire continues, fire extinguisher switch - EXT NO. 2.

MINIMUM CONTROL SPEED

SAFE SINGLE-ENGINE SPEED

SPEEDS GIVEN ARE BASED ON FLIGHT TEST
SEA LEVEL — STANDARD DAY

90 KNOTS IAS

OR STALL SPEED PLUS 5 KNOTS
(WHICHEVER IS HIGHER)

NOTE
Use power-off stall speeds as shown on stall speed chart in Section VI.

V_{MCG} — MINIMUM CONTROL SPEED (GROUND)
V_{MCA} — MINIMUM CONTROL SPEED (AIR)

110 KNOTS IAS

FOR MAXIMUM GROSS WEIGHT— 17,760 POUNDS

Minimum control speed (ground) is the speed at which the airplane can be controlled on the ground with a failed engine and by use of aerodynamic controls alone. The speed is based on the failed engine windmilling, Military Thrust on the good engine, the nose wheel off the runway, and use of ailerons and rudder to maintain directional control within 25 feet of the desired path.

Minimum control speed (air) is the speed required to provide sufficient control to fly a straight path over the ground with a failed engine. This speed is based on the engine windmilling, Military Thrust on the good engine, and no more than 5 degrees bank away from the failed engine. At minimum control speed, it may be necessary to sacrifice altitude for airspeed while putting the airplane in a clean configuration and obtaining sufficient airspeed to climb. Refer to Appendix I for single-engine take-off speed and distance.

TAKE-OFF CONFIGURATION

WING FLAPS	UP
SPEED BRAKE	RETRACTED
LANDING GEAR	UP
WEIGHT	MAXIMUM

125 KNOTS IAS

For other gross weights, use initial climb-out speeds shown on climb-out distance — one-engine chart. Observe weight and temperature limits as shown on take-off ground run chart in Appendix I.

Safe single-engine speeds shown are based on Military Thrust on the good engine.

NOTE
Speeds shown will provide a minimum rate of climb of 200 feet per minute.

LANDING CONFIGURATION

WING FLAPS	ANY POSITION
SPEED BRAKE	RETRACTED
LANDING GEAR	DOWN
WEIGHT	15,000 LB OR LESS†

115 KNOTS IAS

†For heavier gross weights, increase speed 4 knots for each 1000 pounds.

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Figure 3-3

9. Fuel cross-feed and tank selector switch - CROSS-FEED.
10. Fuel - Jettison.
11. Land as soon as practical.

ENGINE AIR START.

Immediate Restart.

In the event of a flame-out above 29,000 feet, the following restart procedure should be attempted:

Caution Unless corrective action is taken immediately, a relight by this procedure is unlikely.

1. Throttle (affected engine) - IDLE.
2. Air start switch (affected engine) - ON.
3. Air start switch - OFF after relight is obtained.

Steps 4 and 5 must be performed if restart is not obtained.

4. Throttle - OFF.
5. Air start switch - OFF.

Further air start attempts should be made using the "Air Start" procedure.

Air Start.

Successful air starts can be made at or below 29,000 feet, within a wide range of airspeeds. (See figure 3-2.) Before attempting an air start, an effort should be made to determine the cause of the engine failure. If the failure is caused by an obvious mechanical breakdown, as indicated by the engine instruments or by excessive vibration, a restart should not be attempted.

1. Airspeed and altitude - Check.

   Airspeed and altitude should be within air start range. (See figure 3-2.)

2. Fuel cross-feed and tank selector switch - CROSS-FEED.
3. Fire pull "T" handle - Check IN.
4. Engine master switch - ON.
5. Air start switch - ON.

Caution The ignition duty cycle is limited to 2 minutes ON, 3 minutes OFF, 2 minutes ON, and 23 minutes OFF.

NOTE If engine rpm is below 8 percent, the starter ignition button may be used to accelerate the start.

- If engine rpm drops below generator cutout speed, it may be necessary to reset the generator after the start is completed.

6. Throttle - IDLE; then as required.

   Check exhaust temperature rise and rpm increase to idle rpm. Then advance throttle as required. If there is no indication of light-up within 20 seconds after the throttle has been moved to IDLE, or if engine fails to accelerate to idle rpm within one minute after light-up, retard throttle to OFF and repeat start attempt.

7. Air start switch - OFF.

NOTE Air start switch must be turned OFF before the generator can be brought back on the line.

8. Fuel cross-feed and tank selector switch - As required.

If Engine Fails to Start or No Start Is to Be Attempted.

If the engine fails to start or the decision has been made not to attempt an air start, proceed as follows:

1. Throttle - OFF.
2. Air start switch - OFF.
3. Engine master switch - OFF.
4. Fuel cross-feed and tank selector switch - Check CROSS-FEED.

   Fuel balancing may be used as required, because the balance switch overrides the throttle-actuated boost pump cutoff switch on the affected engine.

5. Fuel - Jettison (if necessary).
6. Land as soon as possible.

   Depending upon what has caused the engine failure, determine the type of pattern to be flown. If the failure may affect the good engine, it is recommended that the applicable portion of the forced-landing patern be used. (See figure 3-5.) If the failure is isolated and will not affect the operation of other systems, it is recommended that a normal landing be made. (See figure 2-6.) If an airfield cannot be reached and terrain is unknown or unsuitable for a forced landing, bail out.

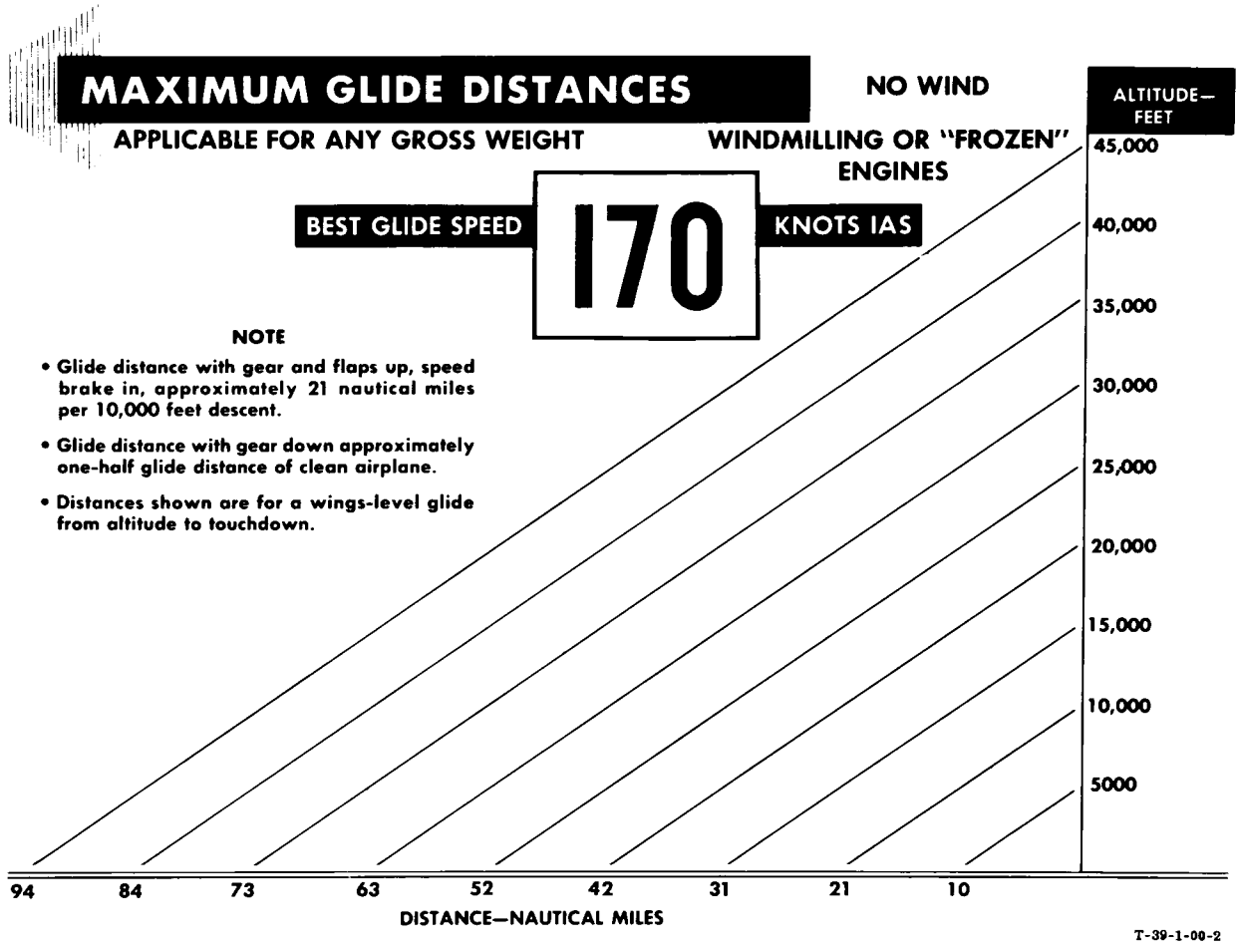


Figure 3-4

MAXIMUM GLIDE.

For maximum glide distance (refer to "Descents" in Part 5 of Appendix I) with both engines failed (windmilling or frozen), the best gliding speed is 170 knots IAS for a clean airplane, with landing gear and flaps up and speed brake in. (See figure 3-4.) When speed is maintained at 170 knots IAS, the glide ratio is about 12.5 to 1. Thus, for every 10,000 feet of altitude, the airplane will glide about 21 nautical miles. The glide ratio and glide distance of the airplane with the landing gear down are about half of those obtainable with the landing gear up.

FORCED LANDING VS BAIL-OUT.

The decision to attempt a forced landing or to bail out (or have only the passengers bail out) remains with the pilot. It is impossible to establish a predetermined set of rules and instructions which would provide a ready-made decision applicable to all emergencies of this nature. The basic conditions listed, combined with the pilot's analysis of the condition of the airplane, type of emergency, and his proficiency, are of prime importance in determining the action to be taken. These variables make a quick and accurate decision difficult. Before a decision is made to attempt a dual flame-out landing, the following basic conditions should exist.

a. Dual flame-out landings should only be attempted on a prepared or designated suitable surface.

b. If both engines are flamed out and there is insufficient altitude to bail out and a prepared surface is not available, land with the landing gear down.

DUAL FLAME-OUT LANDING (TYPICAL)

SPEEDS GIVEN ARE APPLICABLE FOR ANY WEIGHT CONDITION

PROCEDURE TO USE WHEN:
Engines are windmilling or frozen or whenever an emergency requires.

WARNING

If terrain is unknown or unsuitable for dual flame-out landing, bail out.

NOTE

- The wing flaps may be raised if it is necessary to extend the glide distance.
- The speed brake and wing flaps are to be used as required to ensure reaching the landing spot.

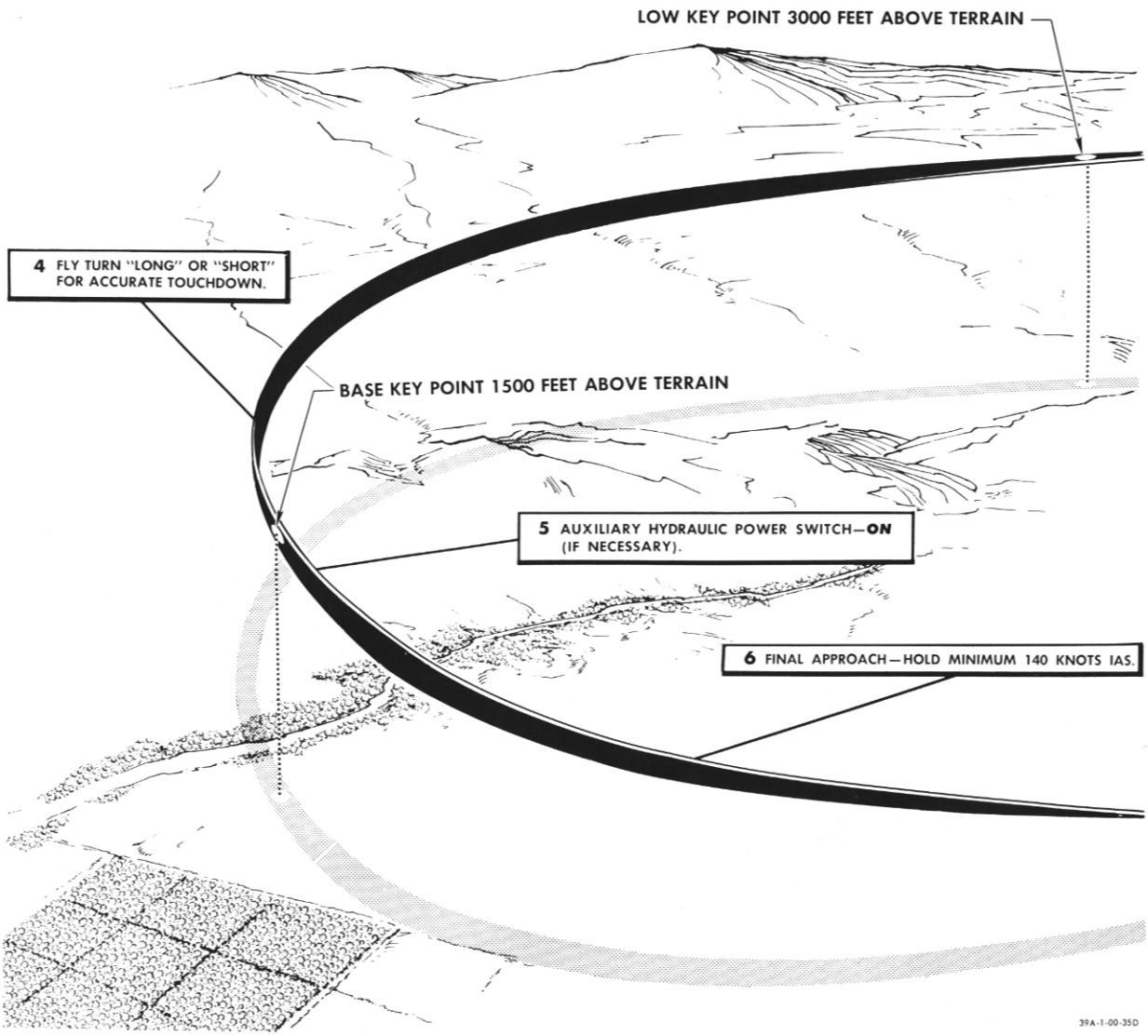
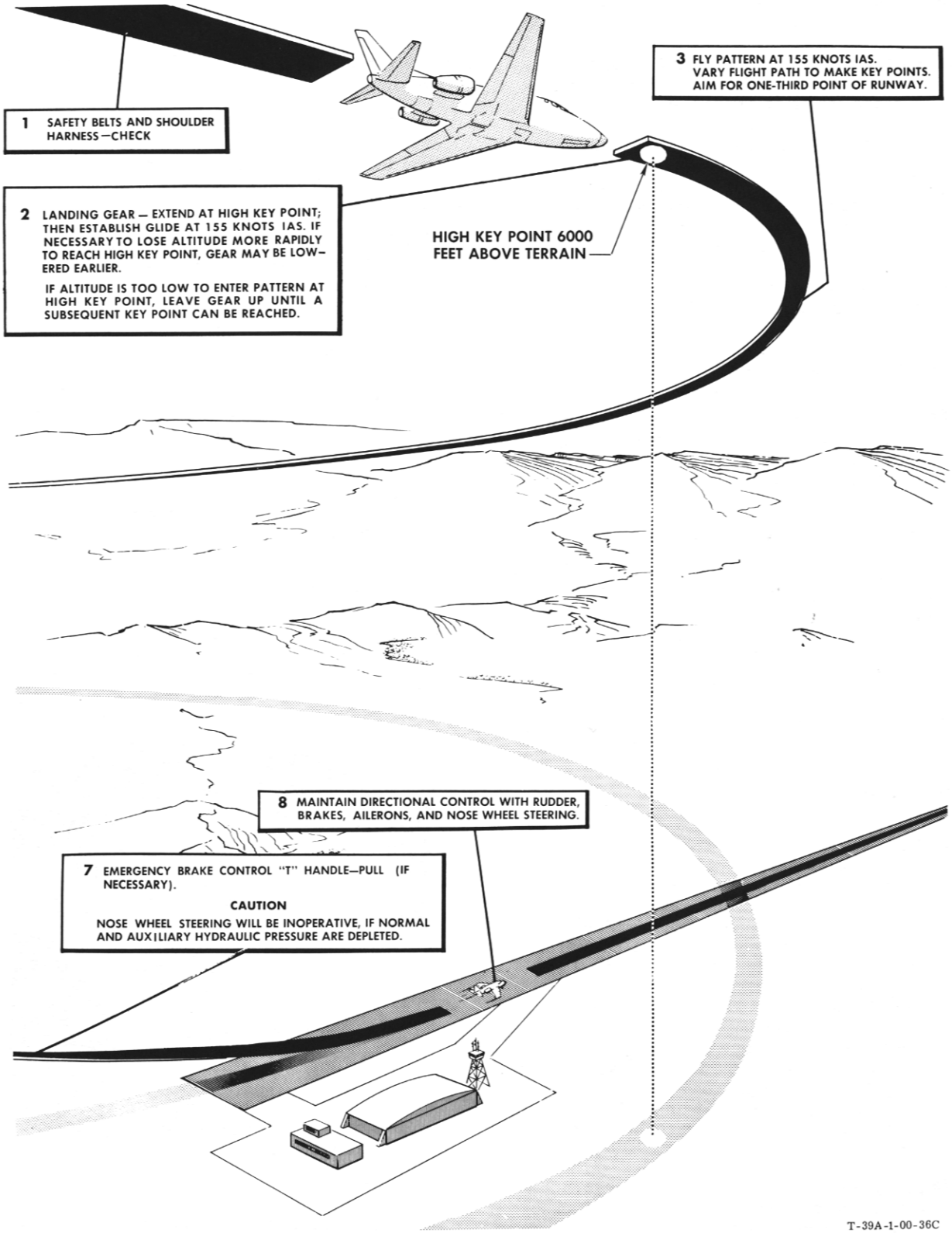


Figure 3-5


1 SAFETY BELTS AND SHOULDER HARNESS—CHECK
2 LANDING GEAR — EXTEND AT HIGH KEY POINT; THEN ESTABLISH GLIDE AT 155 KNOTS IAS. IF NECESSARY TO LOSE ALTITUDE MORE RAPIDLY TO REACH HIGH KEY POINT, GEAR MAY BE LOWERED EARLIER.
IF ALTITUDE IS TOO LOW TO ENTER PATTERN AT HIGH KEY POINT, LEAVE GEAR UP UNTIL A SUBSEQUENT KEY POINT CAN BE REACHED.
3 FLY PATTERN AT 155 KNOTS IAS. VARY FLIGHT PATH TO MAKE KEY POINTS. AIM FOR ONE-THIRD POINT OF RUNWAY.
HIGH KEY POINT 6000 FEET ABOVE TERRAIN
7 EMERGENCY BRAKE CONTROL "T" HANDLE—PULL (IF NECESSARY).
CAUTION
NOSE WHEEL STEERING WILL BE INOPERATIVE, IF NORMAL AND AUXILIARY HYDRAULIC PRESSURE ARE DEPLETED.
8 MAINTAIN DIRECTIONAL CONTROL WITH RUDDER, BRAKES, AILERONS, AND NOSE WHEEL STEERING.

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c. Approaches to the runway should be clear and should not present a problem for a dual flame-out approach.

NOTE If both engines are flamed out and a suitable area is available over which the airplane can be abandoned, do not attempt to land on a field which has approaches located over heavily populated areas.

- If possible, before bail-out, attempt to turn the airplane toward an area where injury or damage to persons or property on the ground or water is least likely to occur.

d. Weather and terrain conditions must be favorable. Cloud cover, ceiling, visibility, turbulence, surface wind, etc, must not impede in any manner the establishment of a proper flame-out landing pattern.

NOTE Night dual flame-out landings or dual flame-out landings under poor lighting conditions, such as at dusk or dawn, should not be contemplated, regardless of weather or field lighting.

FORCED LANDING.

For forced-landing procedures, see figure 3-5 and refer to "Forced Landing VS Bail-out" in this section.

PRECAUTIONARY LANDING.

During emergency operation, when there is doubt of any system capability, a precautionary landing should be made utilizing the applicable forced-landing techniques. (See figure 3-5.)

SINGLE-ENGINE LANDING.

If a single-engine landing is required, it is the pilot's decision as to the type of pattern to be used. If the failure may affect the operation of the good engine, the applicable portions of the forced-landing pattern should be used. If the failure will not affect operation of other systems, normal landing patterns may be used. Two-engine final approach speeds may be used; however, a safe single-engine speed (115 knots IAS minimum) is to be maintained until landing is assured. It is recommended that zero to a maximum of 66 percent flaps be used during the approach, as dictated by runway length and flight conditions. If an engine is lost on final approach with a full flap configuration, the approach may be completed leaving the flaps extended.

NOTE Better single-engine go-around acceleration can be expected with flaps up, because of the lesser drag developed in the no-flap configuration.

SINGLE-ENGINE GO-AROUND.

For single-engine go-around, see figure 3-6.

PRACTICE MANEUVERS (ONE OR TWO ENGINES OUT).

Practice Dual Flame-out Landing.

Dual flame-out landings and approaches may be practiced with both engines at IDLE and the speed brake extended.

NOTE It is recommended that the applicable forced-landing techniques and procedures (figure 3-5) be followed during a simulated forced landing.

Practice Single-engine Landing.

Single-engine landings may be practiced with one engine at IDLE, using either the forced-landing or the normal-landing pattern.

In-flight Engine Shutdown Demonstration.

When demonstrating in-flight engine shutdown, place the throttle of the selected engine at IDLE for one minute before continuing to OFF.

FIRE OR EXPLOSION.

Each engine pod is equipped with a fire and overheat detector circuit and a pressure-type fire extinguisher system. A portable hand fire extinguisher, for use in case of a cabin fire, is mounted on the bulkhead aft of the pilot's seat.

WARNING

Use discretion when the second container is to be selected, as only two extinguishing agent containers are available.

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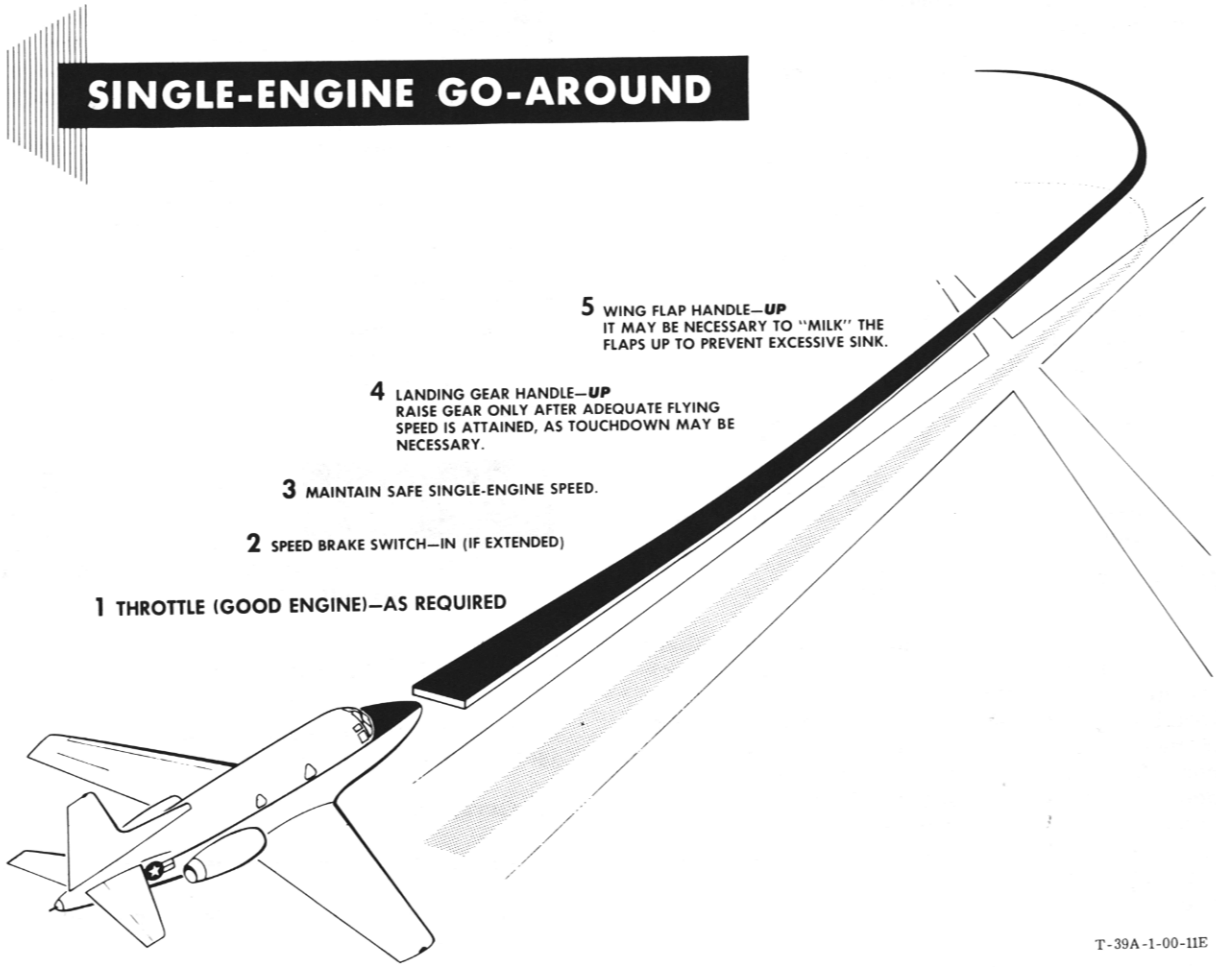

Figure 3-6

Warning Whenever a fire or overheat warning light comes on or a cabin fire is suspected, it is recommended that the passengers be alerted, oxygen masks be used, and that the pilot select 100 percent oxygen.

- Except in an emergency, do not attempt to restart the engine if the extinguisher system has been actuated.
- The extinguishing agent (dibromodifluoromethane) in the engine fire-extinguisher system can produce toxic effects if inhaled.

ENGINE FIRE DURING STARTING.

If the fire and overheat warning light comes on, or there are other indications of fire during engine start, proceed as follows:

1. **THROTTLE—OFF.**
2. **Engine - Windmill.**

   Allow the engine to windmill, holding starter switch in if necessary. If fire does not go out or ground personnel indicate the fire is in the pod, proceed to step 3.
3. **Fire pull "T" handle - Pull (if necessary).**

   When the fire pull "T" handle is pulled, it will arm and direct the fire-extinguisher system.
4. **Fire extinguisher switch - EXT NO. 1.**
5. Starter button - PULL.
6. Engine master switch - OFF.
7. Advise tower.

8. If fire warning still continues, use extinguisher No. 2.

   a. Fire extinguisher switch - EXT NO. 2.

   b. Shut down other engine - if operating.

   c. Engine master switch - OFF.

   d. Electrical master switch - OFF.

      After the fuel shutoff valve has had time to close (about 2 seconds), move electrical master switch to OFF.

FIRE DURING TAKE-OFF OR IN FLIGHT.

If the fire and overheat warning light comes on during take-off or in flight, refer to "Abort" in this section.

ENGINE FIRE AFTER SHUTDOWN.

If fire or overheat warning light comes on or there are other indications of fire after shutdown, check that throttles are OFF. Then turn the battery, electrical master, and engine master switches ON, and motor the engine with the starter for 30 seconds. If fire persists, continue motoring for an additional 60 seconds. If the fire still continues, actuate the fire-extinguisher system and turn OFF the electrical master switch. If conditions permit before leaving the airplane, turn off all electrical switches.

WARNING

Do not attempt to restart the engine until the cause of the fire or overheat condition has been determined.

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Caution When the starter is used to motor the engine, the starter is limited to 2 minutes of continuous operation during any 20-minute period.

During or immediately following engine shutdown, oil or fuel fumes may be noticed coming from the tail pipe or inlet duct of either engine, depending on ground wind conditions. These fumes indicate a presence of fuel or oil in the hot section of the engine. The appearance of black smoke from the tail pipe of either engine after shutdown indicates burning oil or fuel, which could damage the engine. In case either fumes or smoke is present, the engine should be motored the same as for an engine fire.

Warning All personnel should keep clear of the tail pipe for at least 3 minutes if fumes or smoke is present, to prevent possible injury.

ELECTRICAL FIRE AND ISOLATION.

If an electrical fire occurs, proceed as follows to isolate the cause of the fire.

1. Oxygen masks - On.
2. Oxygen regulator diluter lever - 100% OXYGEN.
3. Automatic manual override lever - OPEN (if necessary).
4. Electrical master switch - OFF (VFR only).

NOTE When the electrical master switch is placed at OFF, all systems including the dc generators will be inoperative.

5. All nonessential electrical equipment - OFF.
6. All circuit breakers - Check for indication of defective circuit.
7. If fire persists:

   a. Cabin air selector switch - RAM & DUMP (electrical master switch - ON, momentarily).

   b. Portable fire extinguisher - If needed.

   c. Descend to safe altitude (10, 000 feet).

   d. Land as soon as practical.

8. If fire is isolated:

   a. Electrical master switch - ON.

b. Individually restore all equipment previously turned OFF.

Electrical fires will continue to emit fumes and smoke after the source of fire has been removed. Allow sufficient time for the indication of, or recurrence of, fire to occur when restoring power to equipment that had been turned off.

c. Automatic manual override lever - OPEN (if necessary).

d. Oxygen regulator diluter lever - NORMAL.

CABIN FIRE - NONELECTRICAL.

If a fire is discovered in the cabin, proceed as follows:

1. Oxygen masks - On.
2. Oxygen regulator diluter lever - 100% OXYGEN.
3. Automatic manual override lever - OPEN.
4. Use portable fire extinguisher (if necessary).
5. Descend to safe altitude.

Depending upon the type of fire involved, it may be desired to remain at altitude. For example, if the fire was in a seat, remaining at altitude would help to contain the fire, because of the lack of oxygen after pressurization is dumped.

6. Cabin air selector switch - RAM & DUMP.
7. After air is clear, repressurize cabin.

LOSS OF PRESSURIZATION.

Refer to "Loss of Pressurization" in Section IV.

ELIMINATION OF SMOKE AND FUMES.

If smoke and fumes are detected, proceed as follows:

1. Oxygen masks - On.
2. Oxygen regulator diluter lever - 100% OXYGEN.
3. Automatic manual override lever - OPEN.
4. Descend to safe altitude (10,000 feet) if possible.

If smoke and fumes are detected early enough or are not strong enough to require immediate action, the contaminated air may be isolated by moving the cabin air selector switch to LEFTHAND ENGINE. If this does not eliminate the contaminated air, move the cabin air selector switch to RIGHTHAND ENGINE. If contaminated air persists, proceed to step 5.

5. Cabin air selector switch - RAM & DUMP.
6. Pilot's window - Open (if necessary).

If altitude permits and the contaminated air cannot be cleared and vision is obstructed by smoke or fumes, opening the side window may improve the vision.

BAIL-OUT. See 1SS-48

The optimum altitude and airspeed for bail-out is 120 to 300 knots IAS in 1 G flight between 5000 and 15,000 feet. Bail-out should be made rapidly and in order, so that personnel involved will land as close together as possible. If time and conditions permit, altitude should be reduced, if at all possible, to a level where oxygen is not required. If it is necessary to bail out above 20,000 feet, the crew and passengers should arm their automatic parachute releases immediately before rolling out of the escape hatch. This ensures automatic parachute opening in case consciousness is lost.

Warning If time conditions permit, it is recommended that all bail-outs be made below 20,000 feet. This reduces the possibility of losing consciousness from lack of oxygen after leaving the airplane.

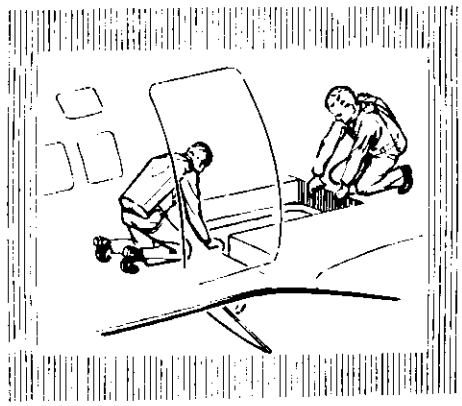
- If bail-out is to be made above 20,000 feet, stay on oxygen until just before leaving the airplane. After assuming the bail-out position, actuate the automatic parachute-arming lanyard just before bail-out.

In certain emergency conditions, it may be desirable to bail out the passengers while the crew remains aboard to attempt to land the airplane or to avoid populated areas. This decision is left to the discretion of the pilot.

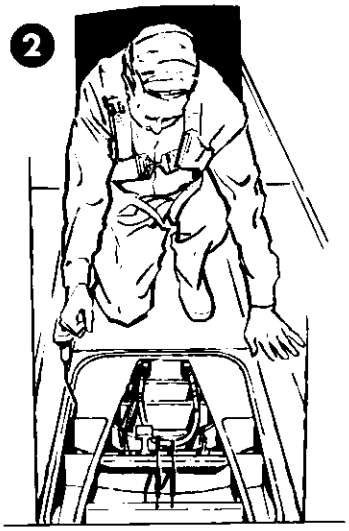
PILOTS' AND PASSENGERS' BAIL-OUT.

Warning Do not bail out from the main entrance door or the ground escape hatch because of the danger of striking the airplane structure. Also, if the main entrance door were opened in flight, the door could obstruct the bail-out escape path of the crew.

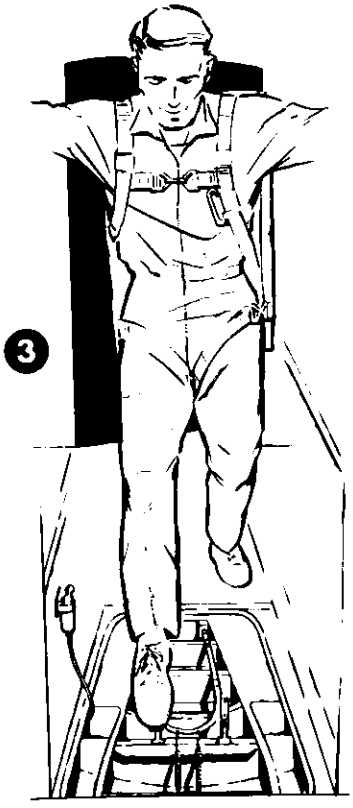
BAIL-OUT PROCEDURES



Lift the in-flight inner escape door and rotate it to the vertical locked position.



Pull "D" handle mounted on bottom of in-flight inner escape door. Pulling the "D" handle will jettison the outer door. If the outer door fails to jettison, proceed to step 3.



If pulling the "D" handle fails to jettison the outer door, then the manual release pedal must be pushed to jettison the outer door.

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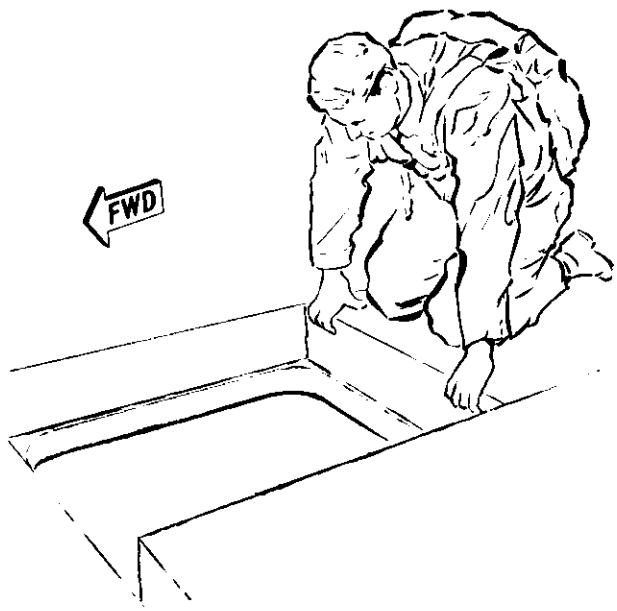
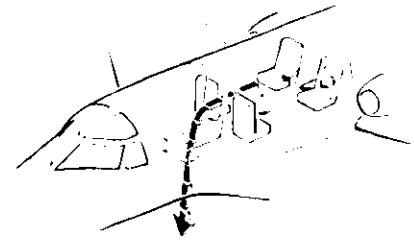
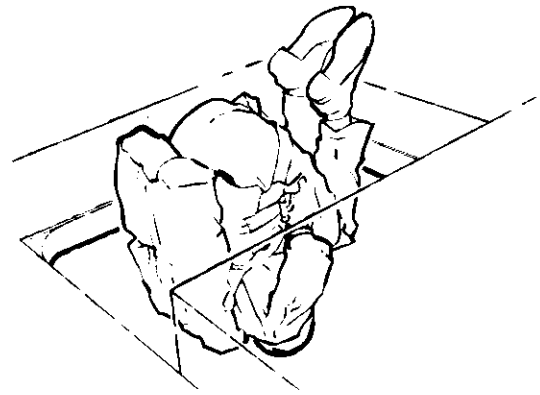
Figure 3-7

PASSENGER

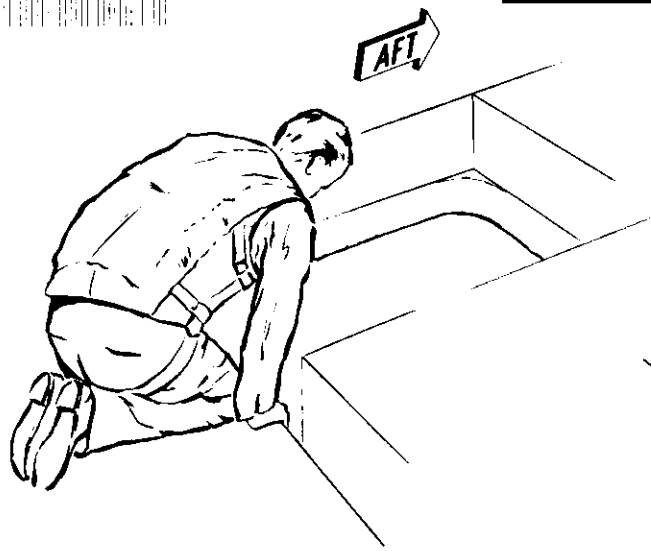


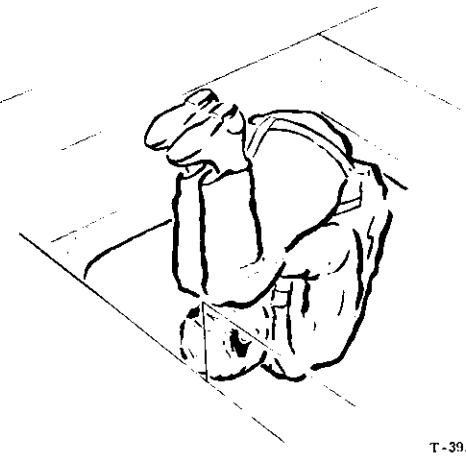




Bail-out of crew or passenger is performed in the following manner: Kneel at the edge of the escape hatch, fold arms across chest, lean forward, and tuck chin. Then roll forward and down through the escape hatch, while pulling knees to chest.

CREW





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For correct bail-out technique and body positions, see figure 3-7 and proceed as follows:

1. Radio distress procedure.
2. Alert passengers.
3. Cabin air selector switch - RAM & DUMP.

   If time and conditions permit, move the cabin air selector switch to RAM & DUMP. This will ensure that cabin pressure is dumped before the in-flight escape hatch is actuated.

4. Landing gear handle - DOWN (if required).

   If the pilot intends to land the airplane, the landing gear should be lowered before the in-flight escape hatch inner door is opened.

Warning Once this inner door is opened, the gear cannot be lowered or the speed brake retracted until the door is again closed.

5. In-flight escape hatch inner door handle - Pull rapidly.
6. In-flight escape hatch outer door "D" handle - Pull.

   If the outer door fails to jettison, push the manual release pedal to jettison the door.

7. Passengers - Bail out.
8. Pilots - Bail out.

TAKE-OFF AND LANDING EMERGENCIES.

ABORT.

The procedure for aborting is basically the same for any take-off emergency. (Refer to "Abort" in this section.)

RUNWAY OVERRUN BARRIER.

Tests reveal that successful barrier engagements with a standard Type MA-1A runway overrun barrier are unlikely. If barrier engagement is unavoidable, retract speed brake and aim nose wheel between the vertical straps of barrier webbing.

TIRE FAILURE.

Tire failure on take-off may present more problems than a tire failure on landing. Directional control is more difficult at the higher take-off gross weights during an abort; therefore, if speed is at or near take-off speed, continue take-off and burn fuel down, or jettison, before landing.

Warning If take-off is continued, the landing gear should not be retracted. If tire failure is suspected, have the tire visually checked for fire by a report from another airplane or the tower, and land as soon as practical. Landing should be made in accordance with the instructions in "Main Gear Tire Failure Landing" in this section.

Nose Gear Tire Failure on Take-off.

Nose gear tire failure is serious if either tire fails on the take-off or landing roll. If one tire has failed or lost pressure, the remaining tire is definitely overloaded and it is much more likely to fail, especially at high gross weights. In case of complete nose gear tire failure on the take-off run and if speed is too slow to continue take-off, the take-off should be aborted. (Refer to "Abort" in this section.)

NOTE If nose gear tire failure occurs at or near rotation, the pilot may elect to continue the take-off in order to reduce the gross weight of the airplane. Control on the ground is much easier at lighter gross weights.

- Even though heavy braking increases the load on the nose gear, it is considered more important that the airplane be stopped as quickly as possible rather than to attempt to lighten nose wheel loading at the expense of a longer roll. However, holding the control wheel full back during braking may reduce some of the load from the nose wheels.

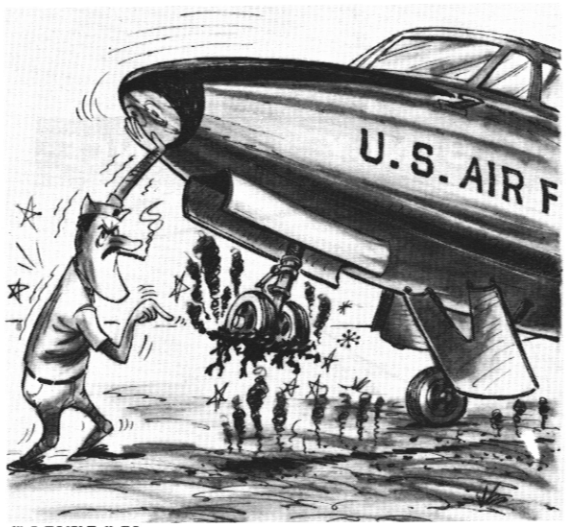
Nose Gear Tire Failure Landing.

When landing is to be made with flat nose gear tire, proceed as follows:

1. Normal approach.
2. Nose wheels - Hold off.

   The nose wheels can be held off longer by retracting the wing flaps, maintaining attitude, and full nose-up trim. Ease nose wheels to runway. When nose wheels touch down, proceed to step 3.

3. Nose wheel steering - Engage.
4. Brakes - As required.



CAUTION

Avoid extreme rudder pedal deflections when nose wheel steering is engaged, since this may cause nose wheels to skid or skip sideways, and steering effectiveness will be lost.

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Main Gear Tire Failure on Take-off.

Directional control is more difficult and braking efficiency is greatly reduced at higher gross weights with failure of one or both main gear tires. Therefore, under certain conditions, the take-off should be continued rather than aborted. (Refer to "Abort" in this section.)

Main Gear Tire Failure Landing.

When landing with a flat main gear tire, proceed as follows:

1. Fuel - Jettison (if necessary).
2. Normal approach.

   Land on side of runway that is away from flat tire. This will reduce the need for differential braking if the airplane pulls toward the low tire.

3. Normal touchdown.
4. Nose wheel steering - Engage (when necessary).

Caution Do not engage nose wheel steering until rudder position is at or near neutral.

5. Wheel brakes - As required.

LANDING WITH ANY ONE GEAR UP.

If any one gear is up and cannot be lowered, retract the other gear if possible, and make a belly landing. If the gear cannot be retracted, land on the extended gear, proceeding as follows:

1. Loose equipment - Secure.
2. Fuel - Jettison (if necessary).
3. Alert passengers.
4. Ground escape hatch - Remove and stow.
5. Safety belts - Tighten.
6. Position and anticollision light switches - OFF.
7. Approach - Normal.
8. Wing flap handle - DOWN.
9. Speed brake switch - IN.
10. Hold unsafe gear off as long as possible.
11. Throttles - OFF.
12. Engine master switches - OFF.
13. Electrical master switch - OFF.

BELLY LANDING.

A skid on the lower fuselage (wing joint) is provided to facilitate a belly landing and to lessen airplane damage. Before a belly landing, jettison as much fuel as practical and proceed as follows:

Caution If the equipment is available and time and conditions permit, the runway should be foamed to eliminate fire hazard and reduce airplane damage.

1. Loose equipment - Secure.
2. Fuel - Jettison (if necessary).
3. Alert passengers.
4. Ground escape hatch - Remove and stow.
5. Safety belts - Tighten.
6. Position and anticollision light switches - OFF.
7. Hold normal approach speed.
8. Wing flap handle - DOWN.
9. Throttles - As required to maintain a minimum sink rate in a level attitude.
10. Speed brake switch - IN.

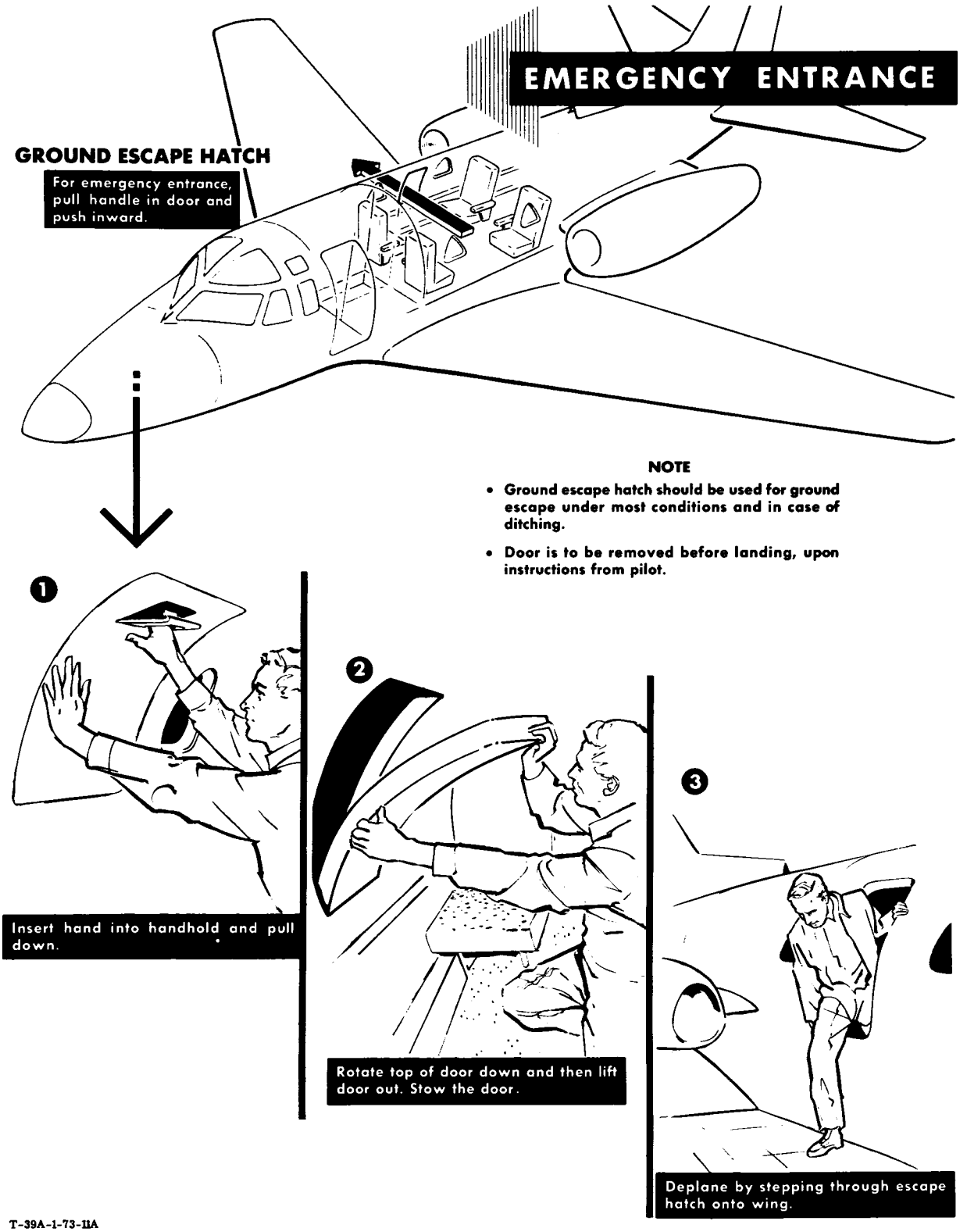
EMERGENCY ENTRANCE
GROUND ESCAPE HATCH
For emergency entrance, pull handle in door and push inward.
NOTE
• Ground escape hatch should be used for ground escape under most conditions and in case of ditching.
• Door is to be removed before landing, upon instructions from pilot.
1
Insert hand into handhold and pull down.
2
Rotate top of door down and then lift door out. Stow the door.
3
Deplane by stepping through escape hatch onto wing.
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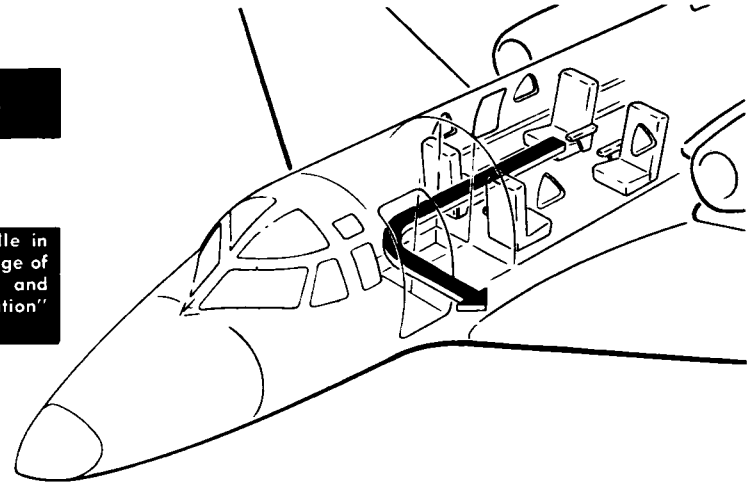
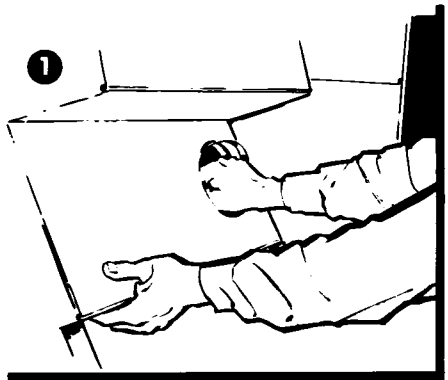
Figure 3-8

AND ESCAPE EXITS

MAIN ENTRANCE DOOR

For emergency entrance, turn handle in door and push inward at the lower edge of the door, rotating the top outward and down. (Refer to "Entrance Door Operation" in Section II.)

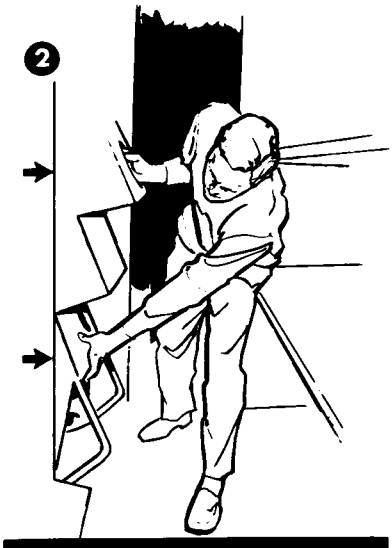




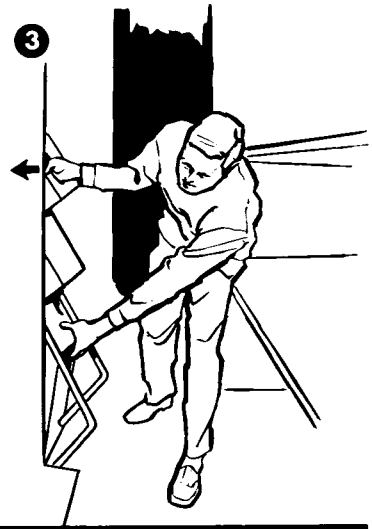
1 With door in place, turn rotary locking handle one-quarter turn clockwise to unlock door.

NOTE

The main entrance door is used for ground escape when fire is present on the right side of the airplane or the emergency condition does not warrant the use of the ground emergency escape hatch.



2 Pull entire door inward first, using an even pressure on the upper and lower sections.



3 Rotate the top of the door outward.

4 Grasp the handles and allow the door to rotate downward until door is in place, or it is resting on ground, depending on condition of airplane.

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11. Throttles - OFF (just before touchdown).

    Retard throttle to OFF just before touchdown. Touch down in a near level attitude.

Caution Avoid touching down in a nose-high attitude, to prevent the airplane from slapping down on the runway at touchdown.

12. Engine master switches - OFF.

13. Electrical master switch - OFF.

LANDING WITH ONE OR BOTH SLATS INOPERABLE.

If one or both wing slats should fail to extend, the final approach airspeed should be increased by 15 knots. Fly the airplane down to the runway. Do not allow the airplane to float. Just before contact with the runway, rotate the nose so that the main gear contacts the runway first.

NO-FLAP LANDING.

No special technique is required for landing without wing flaps, other than extending the pattern. However, during base, turn onto final, and final approach, speed should be increased 5 to 10 knots above normal pattern speeds.

EMERGENCY ENTRANCE AND ESCAPE EXITS.

For emergency entrance and escape exits, see figure 3-8.

DOOR-OPEN-IN-FLIGHT EMERGENCY.

Illumination of the door-open caution light indicates that the main entrance door or in-flight escape hatch outer door is not fully locked closed, or that the in-flight escape hatch inner door has been raised. If any of these conditions exist, pressurization air to the door seals will be shut off and depressurization will occur, illuminating the cabin pressure failed warning light when the cabin altitude goes above 10,000 feet. If depressurization does not occur, the door-open caution light indication is probably false and a faulty light circuit should be suspected. If the door-open caution light comes on in flight, follow this procedure.

1. Fasten seat belt sign - ON.

   All occupants fasten seat belts.

2. Reduce airspeed and altitude.

Caution If possible, avoid use of the speed brake because the door in question may be the in-flight escape hatch outer door and a retracted speed brake will help prevent it from leaving the airplane.

3. Investigate cause of caution light.

   If it can be determined that the warning was caused by raising the inner door, it is safe to close the door and continue the flight in the normal manner. Otherwise, continue flight at reduced speed and land as soon as possible.

4. Fuel - Jettison (if necessary).

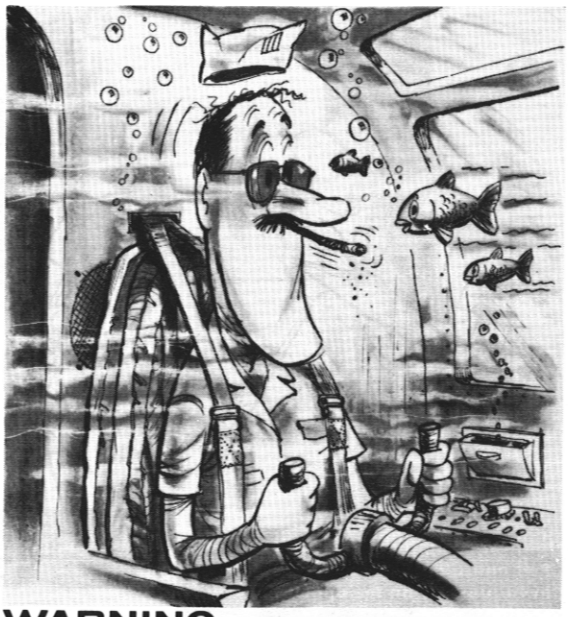
5. Land as soon as possible (if necessary).

   Avoid flight conditions causing positive pressure on the main entrance door, such as yawing and slipping.

Warning Although the main entrance door and the ground escape door are of the plug type, their behavior when unlocked with the fuselage depressurized is unpredictable. Damage to the airplane or injury to the occupants could result if these doors are accidentally opened in flight.

DITCHING.

Calculated data shows that the airplane has good static buoyancy qualities, floating near level or slightly tail-low. Exit should be made from the



WARNING

Do not attempt ditching if the in-flight escape hatch has been jettisoned.

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ground escape hatch. Passengers as well as pilots should be made familiar with their duties, position, and procedures. Jettison as much fuel as possible to lighten airplane and improve flotation. Ditch while power is still available if possible, so that the most desirable approach can be made.

NOTE Make sure adequate lifesaving equipment is aboard before an overwater flight.

- The ditching procedures outlined here are theoretical and are not based on actual flight test.

1. Radio distress procedure.
2. Fuel - Jettison (if necessary).
3. Alert passengers.
4. Ground escape hatch - Remove and stow.
5. Safety belts - Tighten.
6. Landing gear handle - Check UP.
7. Wing flap handle - DOWN.
8. Speed brake switch - IN.
9. Normal approach - Keep wings level and slightly nose-high.

Caution Unless the wind is high or the sea is rough, plan approach heading parallel to any uniform swell pattern, and try to touch down along a wave crest or just after the crest passes. If the wind is as high as 25 knots or the surface is irregular, the best procedure is to approach into the wind and touch down on the falling side of a wave.

10. Throttles - OFF.
11. Leave airplane immediately when stopped, through the ground escape hatch.

FUEL JETTISON.

Placing the fuel jettison switch to AUTOMATIC automatically jettisons fuel to a preset level, depending on flight attitude. An alternate means of jettisoning is also provided by moving the fuel jettison switch to the spring-loaded MANUAL position.

Caution When the fuel jettison switch is held in the MANUAL position, there is no automatic cutoff feature. Caution should be used, as all remaining fuel could be jettisoned.

NOTE Fuel jettison is impossible with failure of both boost pumps.

AUTOMATIC FUEL JETTISONING FAILURE.

During automatic fuel jettisoning, a malfunction of a cell-mounted float switch could cause the respective fuel jettison shutoff valve to remain open. If the valve remains open, all fuel in the respective wing tank will be jettisoned. An open jettison valve is indicated by the "FUEL JETTISON OPEN" caution light remaining on and a continuation of fuel jettisoning (as indicated by abnormal decrease of fuel quantity). If this occurs, proceed as follows:

1. Fuel jettison switch - OFF.

   Automatic shutoff should occur between approximately 1400 and 2200 total pounds of fuel remaining.

2. "FUEL JETTISON OPEN" caution light - Check OUT.
3. Fuel quantity gages - Check.

   Check fuel quantity gages to determine whether fuel jettisoning has stopped. If fuel continues to jettison, proceed to step 4.

4. Left and right fuel jettison circuit breakers - PULL.

AIRPLANE FUEL SYSTEM FAILURE.

Failure of a tank-mounted pump or engine-driven centrifugal fuel pump will cause the corresponding low fuel pressure caution light to illuminate. If the caution light comes on, proceed as follows to preclude a possible engine flame-out.

1. Fuel cross-feed and tank selector switch - CROSS-FEED.

Warning When operating on cross-feed with only one tank-mounted boost pump operating, the last 30 gallons (approximately 195 pounds indicated) of fuel in each wing tank (total of 60 gallons or 390 pounds) may not be available to the operative tank-mounted boost pump to reliably support the fuel flow requirements of two engines. The same conditions will apply when operating on suction feed (both tank-mounted fuel boost pumps inoperative).

2. Low fuel pressure caution light - Check.

   If failure was due to an inoperative tank-mounted boost pump, the low fuel pres-

sure caution light will go out. However, if the centrifugal element of the engine-driven pump failed, the caution light will remain on.

TANK-MOUNTED BOOST PUMP FAILURE.

NOTE With the fuel cross-feed and tank selector switch at CROSS-FEED, one tank-mounted boost pump will maintain normal two-engine operation at all altitudes (provided the remaining boost pump is receiving fuel); however, the wing fuel may become out of balance. If this condition occurs, a steady-state constant-heading sideslip of one-half to one ball deflection with the heavy wing high will correct the condition. Fuel will transfer at a rate of approximately 100 pounds per minute, using one-half ball deflection.

- When operating with one tank-mounted boost pump inoperative, do not use the LH TANK or RH TANK position of the fuel cross-feed and tank selector switch for fuel balancing. Selection of the heavy tank would de-energize the operable tank-mounted boost pump, placing both engines on suction feed.

At high engine thrust settings and low fuel level conditions, the remaining boost pump may not reliably support both engines. Therefore, under the following conditions, place the fuel cross-feed and tank selector switch at the NORM position:

a. On final approach with both engines operating.

b. During other flight conditions when the total required fuel flow for both engines exceeds 2400 pounds per hour and the fuel quantity in the wing of the operating boost pump is 1200 pounds or less.

NOTE With the fuel cross-feed and tank selector switch at NORM, the engine with the inoperative fuel boost pump will be on suction feed.

c. If, during boost pump operation, fuel transfer between the right and left wing tanks is insufficient to limit the fuel unbalance between them to 200 pounds maximum.

NOTE The indicated fuel unbalance will not be accurate if the airplane is flying one wing high.

The engine-driven centrifugal fuel pump has suction-feed capabilities in case of tank-mounted boost pump failure; however, this capability is limited, dependent upon fuel temperature. The engines will operate better on suction feed (tank-mounted boost pump inoperative) at higher altitudes with "cold soaked" fuel than they will with warmer fuel.

The airplane has demonstrated suction-feed capabilities up to 15,000 feet altitude, regardless of fuel temperature. With "cold soaked" fuel, engines have operated on suction feed up to 29,000 feet.

NOTE Take-off must not be attempted if a boost pump is inoperative.

ENGINE OIL SYSTEM FAILURE.

OIL PRESSURE (ABOVE 50 PSI).

If oil pressure indicates above 50 psi during flight, proceed as follows:

1. Throttle - Reduce thrust.
2. Oil pressure - Monitor.

NOTE If a reduction in thrust will bring the oil pressure within limits, continue operation at reduced thrust and monitor oil pressure closely. If throttle reduction will not reduce oil pressure within limits, or there is any subsequent increase in pressure, proceed to step 3.

3. Throttle - OFF.
4. Fuel - Jettison (if necessary).
5. Land as soon as possible.

OIL PRESSURE (35 TO 40 PSI).

If, during flight, the oil pressure drops to the 35 to 40 psi range and is steady, reduce thrust on the affected engine to below 90 percent rpm and proceed with the flight. The condition must be corrected before the next flight. If the oil pressure fluctuates in the 35 to 40 psi range, proceed as follows:

1. Throttle - Reduce thrust.

   Reduce thrust until the fluctuation stops; if fluctuation does not stop at idle rpm, proceed with step 2.

2. Fuel - Jettison (if necessary).
3. Land as soon as practical.

OIL PRESSURE (BELOW 35 PSI).

If oil pressure drops to or fluctuates below 35 psi, proceed as follows:

1. Shut down engine.
2. Fuel - Jettison (if necessary).
3. Land as soon as possible.

ENGINE OIL OVERHEAT.

Whenever the engine oil inlet temperature exceeds 121°C as indicated by either of the oil overheat caution lights coming on, check the related pressure gage. If the overtemperature is experienced after a reduction in throttle setting, for example, as thrust is reduced from climb to cruise, it is recommended the throttle be advanced. This will serve to increase the fuel flow, thereby increasing the cooling capacity of the oil-cooling unit until the heat rejection from the engine can be accommodated.

High oil temperatures experienced during level, constant thrust operation may indicate an engine or oil system malfunction. Under these conditions, reduce thrust in an attempt to control oil temperature. In either case, if the oil temperature cannot be controlled within limits, either shut the engine down, or land as soon as practical.

Caution If the temperature does not return to the operating range within a reasonable time after the throttle is advanced, the oil pressure gage should be closely monitored, as an engine oil system failure and subsequent engine failure could occur.

ELECTRICAL POWER SYSTEM FAILURE.

DC GENERATOR FAILURE.

If the dc generator-off caution light comes on, check the dc loadmeters to determine which dc generator has failed. The other dc generator is capable of supplying essential electrical power needed for operation. If one generator has failed or has been disconnected for any reason, the dc secondary busses are disconnected. However, the generator-off caution light will be on. If the engine is operating, attempt to bring the generator back into the circuit as follows:

NOTE When the electrical master switch is OFF, all normal dc and ac power and all warning and caution lights will be inoperative (except power for bail-out alarm).

1. Generator circuit breakers - Check.

   If any of the generator circuit breakers are popped, attempt to reset them. If any pop again, do not reset.

2. Generator switch - RESET, momentarily; then move to ON.

   If the caution light remains out and the loadmeter shows normal system loads, the failure was temporary. If the caution light comes on again, turn generator switch to OFF.

NOTE If the dc generator fails to reset and flight conditions permit, attempt to reset by turning both dc generators off and resetting them one at a time.

Caution If either engine-driven dc generator fails or is turned off, the respective windshield ac generator will be inoperative.

DC GENERATOR OVERHEAT. †

If either dc generator overheat caution light comes on, move the affected generator switch to OFF.

NOTE The dc generator overheat light may come on during engine start, or during taxi out for take-off. These conditions need not cause undue concern. However, if the caution light is not out before take-off, turn the related generator switch to OFF and discontinue the mission.

FAILURE OF BOTH DC GENERATORS.

In flight, if the dc generator-off caution light comes on and the loadmeters indicate both generators have failed, the paralleling bus will be automatically disconnected and the essential bus emergency relay is energized closed, providing an automatic connection between the battery bus and the dc essential bus. Attempt to bring the generators back into the circuit as follows:

Caution The battery switch should be placed at ESSENTIAL only after it has been determined that the essential bus emergency relay has failed to transfer power operations.

- All dc busses except the dc essential bus are automatically disconnected from the battery bus, so that the remaining battery power will be conserved for essential purposes only.
- Failure of both dc generators in flight will cause a loss of the hydraulic pump. The hydraulic pump will operate on the ground if battery power is available.

NOTE If the automatic connection between the battery bus and the essential bus fails, the pilot can manually energize the essential bus emergency relay by moving the battery switch to ESSENTIAL.

1. Generator circuit breakers - Check.

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†Airplanes not changed by T.O. 1T-39-774

2. Generator switches - RESET, momentarily; then ON.

   If the caution light remains out, the failure may have been temporary.

3. DC loadmeter - Check.

   If dc loadmeters show normal system load on both generators, continue mission. If the generators fail to reset, attempt to reset again. If generators fail to reset after several attempts to reset, proceed with step 4.

4. Generator switches - OFF.

5. Battery switch - ESSENTIAL (if necessary).

   The length of time that usable battery power is available for continuous operation is approximately 45 minutes. Battery output may be decreased, however, by a number of variable factors, including low state of battery charge.

6. All nonessential electrical equipment - OFF.

   Turn off all nonessential equipment and any essential equipment that flight conditions permit.

7. Fuel - Jettison (if necessary).

8. Land as soon as possible.

WINDSHIELD GENERATOR FAILURE.

Refer to "Windshield Anti-icing System" in Section IV.

INVERTER FAILURE.

In case of a main inverter failure, essential ac power requirements automatically transfer to the stand-by inverter. The main inverter failure caution light will come on, and the ac instrument power-off caution light may come on momentarily. If the ac instrument power-off caution light stays on, manually move the inverter switch to STANDBY.

NOTE IFF and TACAN are among the items lost in case of main inverter failure.

NOSE WHEEL STEERING SYSTEM FAILURE.

If an automatic transfer to the stand-by nose wheel steering occurs during take-off, nose wheel steering will remain engaged when the airplane becomes air-borne. After lift-off and before landing gear retraction, the nose wheel steering system selector switch must be moved to STANDBY and returned to MAIN to disengage the stand-by system. Disengagement of the stand-by system is indicated by the nose wheel steering-on indicator lights, main steering system failure caution light, and master caution lights going out.

Caution If these lights remain illuminated, do not raise the landing gear. Leave the landing gear down and land as soon as practical.

If the use of nose wheel steering is contemplated during the landing roll, leave the nose wheel steering system selector switch at MAIN until the nose wheels are firmly on the runway and the rudder pedals are at or about neutral; then select STANDBY.

NOTE Do not engage nose wheel steering by using the steering buttons on the control wheel.

NOSE WHEEL STEERING EMERGENCY DISCONNECT.

If a malfunction of the nose wheel steering system occurs and is jeopardizing directional control of the airplane, a free-castering nose gear may be obtained as follows:

1. Electrical master switch - OFF.

NOTE When the electrical master switch is placed at OFF, all electrical systems including the dc generators will be inoperative.

2. Nose wheel steering selector switch - MAIN.

3. Electrical master switch - ON.

NOTE Further operation of the nose wheel steering system is not recommended until the system has been checked by maintenance.

HYDRAULIC POWER SYSTEM FAILURE.

Illumination of the hydraulic pressure/power-off caution light for less than 15 seconds without illuminating the master caution lights requires no immediate action. Monitor normal hydraulic system pressure and select the auxiliary accumulator before landing to ensure availability of hydraulic pressure for use during the landing roll.

When the master caution lights illuminate in conjunction with the hydraulic pump pressure/power-off caution light, proceed as follows:

1. Hydraulic pump switch - OFF & RESET; then ON.

2. Hydraulic and master caution lights - Check out.

   After resetting, as hydraulic pressure increases above 2600 psi, the hydraulic pump pressure/power-off caution light should go out. If no pressure build-up is noticed, a pump motor overtemperature condition is indicated and it may be necessary to wait approximately 5 minutes until the pump has cooled sufficiently to permit resetting. If pressure builds up but does not return to normal, proceed to step 3.

3. Hydraulic pump switch - OFF.

4. Speed brake switch - OFF (center).

5. Auxiliary hydraulic power switch - ON (when necessary).

Warning The speed brake should be used only when essential to the mission, and then for only one extension. Monitor auxiliary pressure closely during speed brake extension. If pressure drops to 1900 psi, return the speed brake switch to OFF (center) to conserve the remaining fluid and pressure for nose wheel steering and braking during landing.

Do not attempt to taxi the airplane with less than 1700 psi available for the nose wheel steering and brakes. Taxiing with the emergency brakes only is not recommended.

SPEED BRAKE SYSTEM FAILURE.

To close the speed brake in flight, in case of a hydraulic failure, move the speed brake switch to the OFF (center) position. Placing the speed brake emergency dump switch at DUMP then dumps any trapped hydraulic fluid and allows air loads to return the speed brake to a trail position. Then return the switch to NORMAL. This creates a hydraulic lock that prevents the speed brake from lowering.

Should an electrical malfunction cause the speed brake switch to remain energized in the OUT position, the speed brake dump valve becomes inoperative. To restore electrical energy to operate the dump valve, pull the speed brake power circuit breaker on the left console. This circuit breaker should not be reset until the electrical malfunction has been corrected.

LANDING GEAR EMERGENCY OPERATION.

LANDING GEAR EMERGENCY RETRACTION ON THE GROUND.

If it is necessary to retract the landing gear when the airplane is on the ground, press the landing gear downlock override button. This mechanically removes the gear handle lock, allowing the landing gear handle to be raised when the weight of the airplane is on the landing gear.

Warning Use of the landing gear downlock override button is not recommended because of unsymmetrical gear retraction, which could cause a more severe condition than originally existed.

LANDING GEAR IN-FLIGHT EMERGENCY RETRACTION.

If the landing gear warning light (steady light in the landing gear handle knob) remains on after the gear handle is placed in the UP position, proceed as follows:

1. Maintain airspeed below gear-down limit speed.

   If the landing gear warning light remains ON, proceed with step 2.

2. Landing gear handle - DOWN.

   Check landing gear position indicators for safe indication.

3. Landing gear electric reset button - Press.

4. Landing gear handle - UP.

   If the landing gear fails to retract, proceed to step 5.

5. Landing gear handle - DOWN.

6. Fuel - Jettison (if necessary).

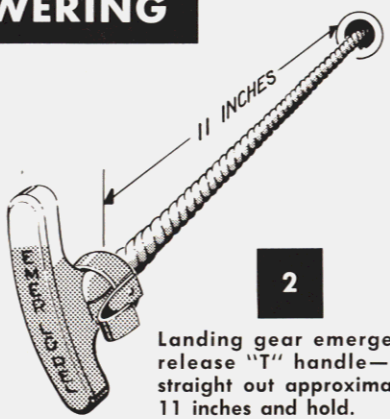
7. Land as soon as practical.

LANDING GEAR EMERGENCY LOWERING.

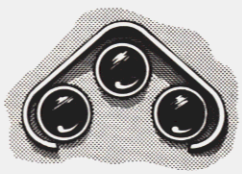
For the landing gear emergency lowering procedure, see figure 3-9. If landing gear emergency lowering is necessary because of a known hydraulic pump failure, this procedure will conserve re-

LANDING GEAR EMERGENCY LOWERING

1 Airspeed—Reduce below normal gear lowering speed. 120 knots IAS is recommended for fastest lowering.



2 Landing gear emergency release "T" handle—Pull straight out approximately 11 inches and hold.

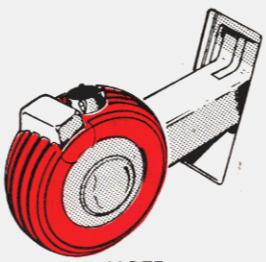


3 Landing gear position lights—Check for safe indication; then release landing gear emergency release "T" handle.

NOTE

- A smooth and gradual increase of aileron and rudder force which results in a yaw angle of a single ball width deflection should be held until the respective main gear locks down. Repeat single ball width deflection for the other main gear. However, if the main gear still fails to lock, the yaw angle may be increased as much as required, so long as gear limit speed is not exceeded.
- All landing gear should lock down in approximately 30 seconds; this time may be longer during cold-weather operation

4 Landing gear handle—**DOWN** (if possible).



NOTE

Light shown illuminated for information only.

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Figure 3-9

maining pressure in the normal system accumulator.

NOTE Normal system leakage during extended flight and/or cycling the landing gear control handle before using the emergency lowering procedure will tend to deplete any normal system accumulator pressure.

Should the landing gear fail to remain fully extended when the landing gear emergency release "T" handle is stowed after an emergency extension, a landing gear selector valve failure is indicated. Should the selector valve fail in the landing gear up position, it will be necessary to repull the emergency release "T" handle and place the restraining hook in the cutout provided. In addition to retaining the release "T" handle, turning off the hydraulic pump will further ensure against inadvertent gear retraction.

Warning Do not release the landing gear emergency release "T" handle until normal hydraulic system pressure is depleted.

Before landing, place the speed brake switch in the OFF (center) position and select the auxiliary hydraulic system to operate the wheel brakes and nose wheel steering. If the auxiliary system pressure drops below 1700 psi, stop the airplane and have it towed to the ramp.

Caution Do not turn on the hydraulic pump, as this will cause the landing gear to retract.

If the landing gear emergency lowering procedure has been thoroughly followed and an unsafe landing gear indication is observed in the cockpit (failure to have "three in the green" or the red light in the gear handle), a tower fly-by or chase plane may verify the landing gear position. If the landing gear appears to be fully extended and the decision is made to make a normal landing, the approach, touchdown, and ground roll should be held as straight as possible. At the end of the ground roll, stop the airplane and visually check all downlock pins. The main gear inspection can be made from behind the wing by looking up into the strut wells outboard of the main gear struts. The nose gear downlock pins can be inspected from behind the nose strut by looking up into the nose wheel well from either side of the forward fuselage. Insertion of the maintenance safety locks will not ensure a safe gear condition.

SIMULATED EMERGENCY LOWERING.

Emergency lowering of the landing gear can be demonstrated by using the "Landing Gear Emergency Lowering" procedure in this section.

Caution Do not press the landing gear electric reset button preparatory to gear retraction until the landing gear handle and the landing gear are both in the down position.

WHEEL BRAKE FAILURE.

If wheel brake failure occurs or appears imminent during ground operation as a result of normal and auxiliary hydraulic system failure, the emergency braking system should be selected. To initiate emergency braking, pull the emergency brake control "T" handle and apply intermittent pressure to the top of the rudder pedals to "pump up" the brakes. Five applications, with resulting time lag, may be required to pump up the brake pressure to obtain emergency braking. Once the pressure is built up, do not release the pedals completely; otherwise, the pumping action will have to be repeated.

When the emergency brake system is used, only one pilot is to operate and pump the brakes to ensure effective braking. In flight, if it is anticipated that the emergency brake system will be required for landing, it should be selected before touchdown.

Warning To preclude landing with a locked wheel brake, do not pump up and hold brake pedals down before landing.

After touchdown, the brake pressure should be built up and maintained before rudder effectiveness is lost. When committed to emergency braking, do not revert to normal braking.

NOTE Do not attempt to taxi on the emergency brake system, other than to clear the runway.

Emergency braking may be simulated by pulling out the emergency brake control "T" handle. However, without hydraulic system failure, reservoir air pressure will be available to minimize the pumping action required to obtain effective braking.

TRIM FAILURE.

If any of the trim systems should fail in either extreme-travel position, the force required to neutralize the controls or to move the control surface to the opposite extreme is not beyond physical capabilities. If a failure occurs in the rudder trim switch or the normal trim switch on the control wheel, proceed as follows:

1. Trim circuit breakers - Check IN.
2. Trim control selector switch - ALTERNATE.
3. Elevator, aileron, and rudder alternate trim switches - Use as necessary.

RUNAWAY TRIM.

If the horizontal stabilizer or ailerons continue to trim after the normal trim switch has been returned to center (resulting in excessive trim), follow this procedure:

1. **TRIM EMERGENCY DISCONNECT SWITCH—PRESS.**

   This de-energizes the normal trim circuit.

2. Trim control selector switch - OFF.
3. Trim emergency disconnect switch - Release.

   Check that trim malfunction has stopped.

4. Trim control selector switch - ALTERNATE; then trim as required.

   Place the trim control selector switch at ALTERNATE, and check to see whether the trim malfunction has stopped. If the runaway trim condition is still evident, proceed with step 5.

5. Trim control selector switch - OFF (if necessary).

AUXILIARY EQUIPMENT

SECTION IV

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AIR CONDITIONING AND PRESSURIZATION SYSTEM.

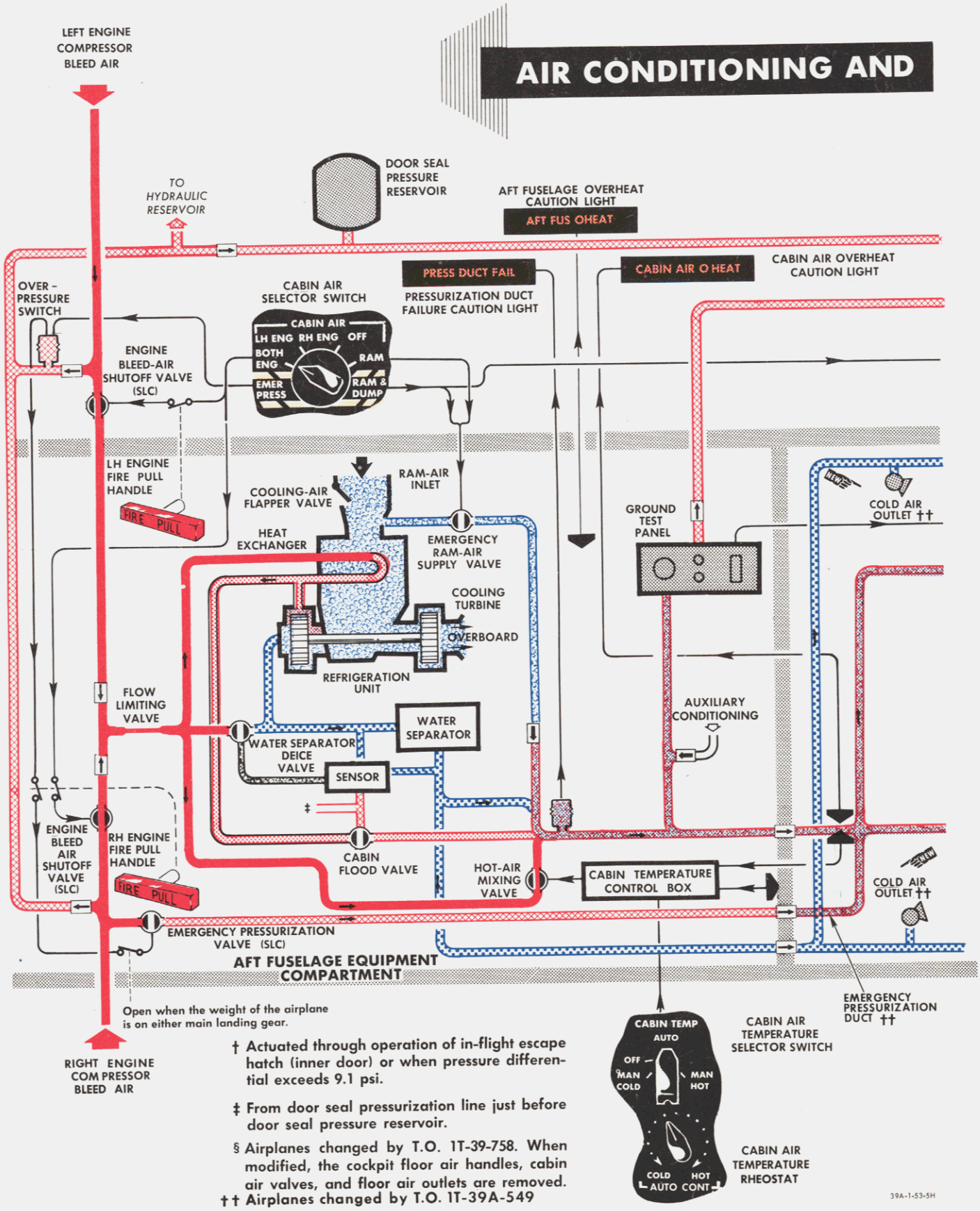
When an engine is started, engine compressor air is available for the air conditioning system. The same air is used for the pressurization system when the weight of the airplane is off of the main gear. The air is extracted from the final engine compressor stage through four ports, two on each engine. These ports are manifolded at each engine to form a single duct which is routed into the aft fuselage. Air is bled from this duct for pressurization of the entrance door and in-flight escape hatch outer seals. In the aft fuselage, the duct from each engine is joined into a common duct which routes the hot compressor air through or around a heat exchanger and refrigeration unit as required. In this manner, either engine is capable of furnishing air to the complete system. The system conditions this relatively hot air for the occupant's comfort. For emergency operation, ram air is used to ventilate the airplane.

Controls for the system are on the center pedestal and are accessible to either the pilot or copilot. Temperature and pressure selected by these controls are automatically controlled by the system. Each engine has a bleed-air shutoff valve which is provided to protect the surrounding structure and equipment in case of downstream duct rupture or air contamination. An emergency pressurization duct is installed to provide cabin emergency pressurization in case of a pressurization duct rupture.

Air from the common duct of the two engines passes through a flow-limiting valve and divided one branch to be cooled, the other to remain hot. The air to be cooled passes through the heat exchanger of the unit where it is partially cooled by a crossflow of ram air before being directed to an expansion turbine for further cooling. This cold air then passes through a water separator and divides. One branch joins the hot-air line; the other continues into the pressurized section to supply cold air to six or, on some airplanes,† eight adjustable outlets. A cabin flood valve permits air that has been tempered in the heat exchanger to bypass the cooling turbine and water separator and enter the supply line downstream of a hot-air mixing valve. In bypassing these two high-pressure-drop items, the flood valve automatically provides an adequate amount of air to the cabin under conditions where the supply bleed-air pressure is only slightly higher than cabin pressure, such as during a descent from high altitude. Downstream of the hot-air mixing valve, a ram-air line enters the system to provide an emergency air supply. The hot-air branch from the flow-limiting valve passes through the hot-air mising valve and joins the cold air from the refrigeration unit and heat exchanger. The hot-air mixing valve operates automatically to admit the proper amount of hot air into the lines in response to cockpit temperature controls and sensors. The air, mixed to the proper temperature by the mixing valve, enters the cabin through flush panels to provide thermostatically controlled air at low velocity. The ducting continues through the cabin to cockpit outlets. These cockpit outlets will emit the same temperature air as in the cabin. On some airplanes,† all conditioned air entering the cabin is ducted through mufflers to reduce cabin noise.

The interior is pressurized by the flow of air from the cockpit and cabin air outlets. Cabin pressure is automatically controlled by a cabin pressure regulator which controls the outflow of pressurized air from the interior. In case of emergencies, pressurization can be dumped by a cabin pressure dump valve. The cabin pressure regulator oper-

†Airplanes changed by T.O. 1T-39A-549



† Actuated through operation of in-flight escape hatch (inner door) or when pressure differential exceeds 9.1 psi.

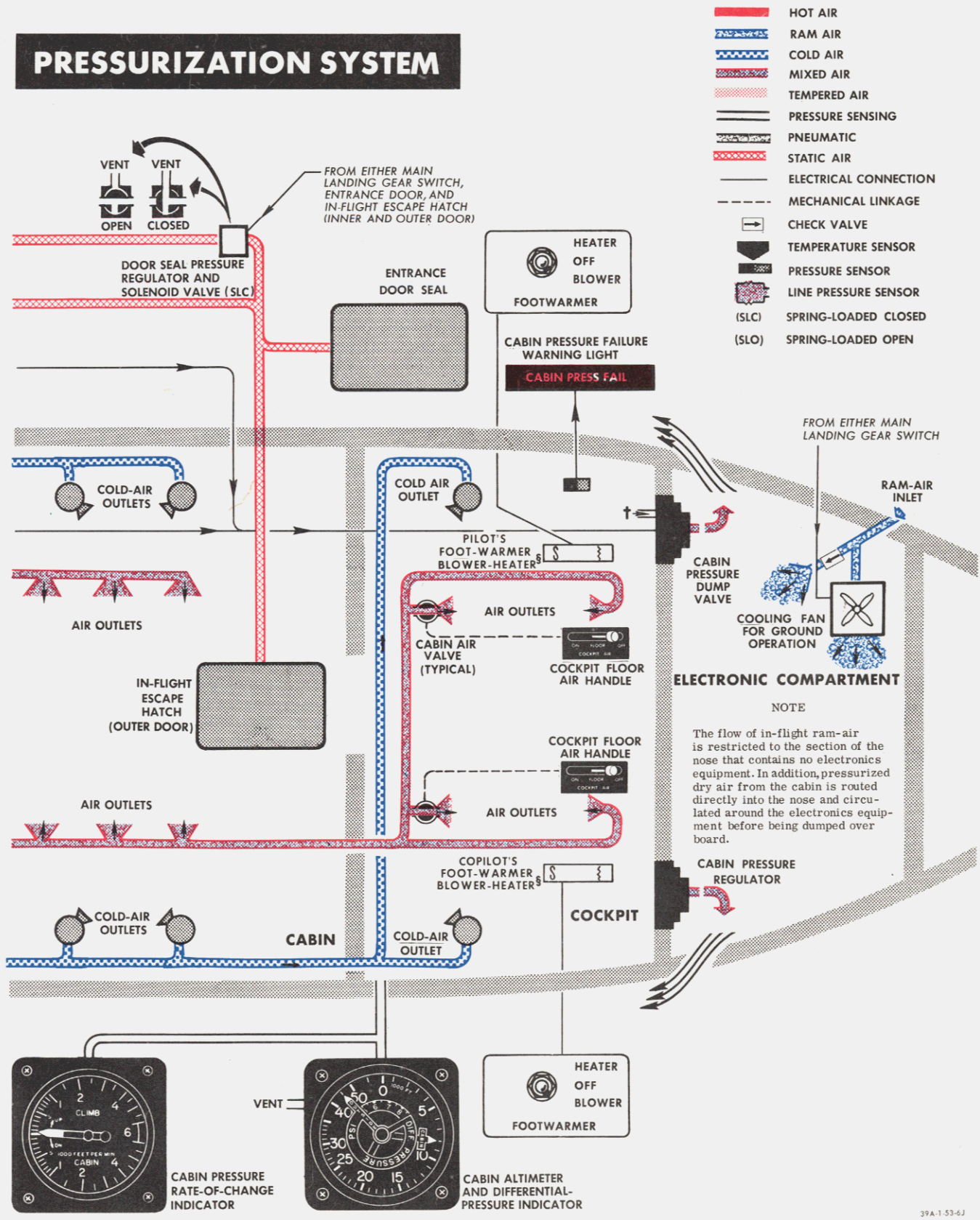
‡ From door seal pressurization line just before door seal pressure reservoir.

§ Airplanes changed by T.O. 1T-39-758. When modified, the cockpit floor air handles, cabin air valves, and floor air outlets are removed.

†† Airplanes changed by T.O. 1T-39A-549

Figure 4-1

PRESSURIZATION SYSTEM



ates completely pneumatically; no outside source of energy is required for its operation. An 8000-foot cabin altitude is maintained from 8000 up to 45,000 feet. Above 45,000 feet, an 8.8 psi differential is maintained.

NOTE Below 8000 feet, cabin pressure is slightly higher than ambinet pressure.

If cabin pressurization is lost, and the cabin altitude exceeds 10,000 feet (provided the passengers' oxygen toggle valve is on), the oxygen system will be activated. At the same time, the oxygen warning horn sounds, the "NO SMOKING" and "WEAR OXYGEN MASK" compartment signs illuminate, the cabin lights come on, the cabin oxygen mask compartment doors open, and the oxygen system is put into operation.

In case of pressurization duct failure, indicated by illumination of the pressurization duct failure caution light in the cockpit, cabin pressurization can be maintained by use of an emergency pressurization duct that is opened by the cabin air selector switch. The emergency pressurization air is supplied only by the right-hand engine. Provisions are made for ground testing the entire pressurization system. The air conditioning and pressurization system is shown schematically in figure 4-1. Ground cooling of the electronic equipment is accomplished by an electrical blower when the airplane weight is on the gear.

NOTE In case of a complete electrical failure, the source of pressurization will be lost.

FOOT WARMERS.†

The cockpit and cabin are equipped with foot-warming devices. In the cockpit, the pilot and copilot have an electrically powered combination heater-blower unit mounted under each seat. The units circulate air locally around the pilot's and copilot's feet, and may be operated independently of each other as a heater-blower combination, or as a blower only. The cockpit floor air handle and manual selectors with Teleflex cables and cabin air valves have been removed. The original foot-warmer ducting has been removed. In the cabin added foot comfort is provided by electrical heating pads, installed under the carpeting between the front- and rear-facing passenger seats, one on each side of the cabin. In addition, some airplanes‡ have electric heating pads installed under the carpeting in front of the two-passenger/baggage seat. Operation of the heating pads is automatically controlled by a thermostat (no pilot control). The heating elements in the pads cycle on when the airplane structure temperature drops to 45°F and cycle off when the temperature rises to 60°F. Both the cockpit heater-blowers and cabin heating pads are powered by the No. 1 dc secondary bus.

Caution Do not stow personal objects or equipment under pilot's or copilot's seat. Objects placed close to foot warmers may sustain heat damage and/or constitute a fire hazard.

CABIN EMERGENCY PRESSURIZATION.

An emergency pressurization duct from the bleed-air system of the right-hand engine can be manually selected to supply cabin emergency pressurization air in case of a failure of the normal pressurization duct. (Duct failure in the normal pressurization system is indicated by illumination of the pressurization duct failure caution light in the cockpit.) The emergency pressurization system is capable of maintaining a 15,000-foot cabin altitude. The emergency pressurization air to the cabin is picked up between the bleed-air shutoff valve and the engine, and is routed through an electrically controlled shutoff valve directly into the cabin through a check valve. On some airplanes,† additional pressurization ducting is added to direct emergency cabin pressurization air into the distribution ducts to the cabin and cockpit air outlets. The emergency pressurization valve is opened by selecting EMERGENCY PRESSURIZATION on the cabin air selector switch. The bleed-air pressure is sensed by an overpressure switch which closes the emergency pressurization valve whenever the pressure exceeds about 60 psi. The valve is also closed, regardless of the position of the cabin air selector switch, if the weight of the airplane is on either main landing gear of if the fire-extinguisher handle for the right-hand engine is pulled.

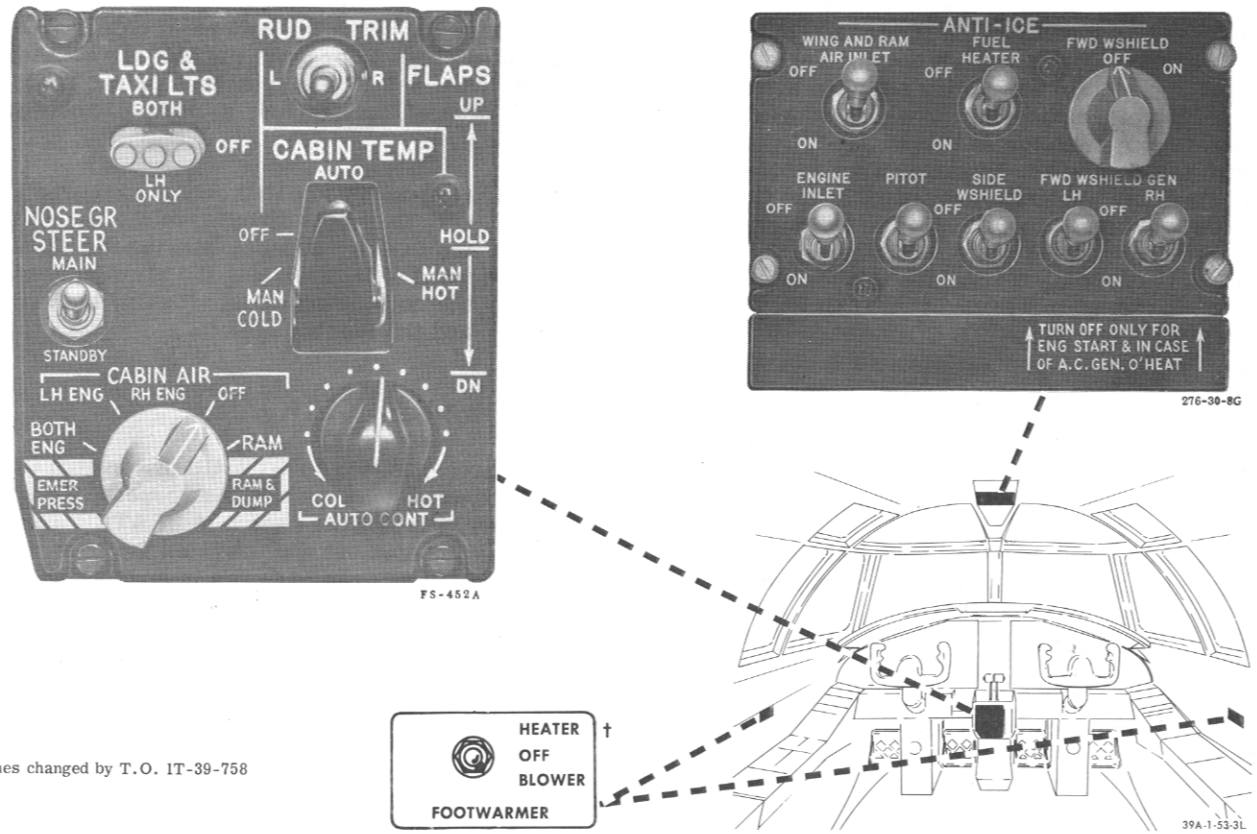
NOTE When operating on emergency pressurization, cabin temperature control is not available. Reducing thrust on the right-hand engine will minimize the temperature rise in the cabin.

CABIN AIR SELECTOR SWITCH.

The seven-position cabin air selector switch (figure 4-2), on the center pedestal, is powered by the ac and dc essential busses and has EMERGENCY PRESSURIZATION (labeled "EMER PRESS"), BOTH ENGINES (labeled "BOTH ENG"), LEFTHAND ENGINE (labeled "LH ENG"), RIGHTHAND ENGINE (labeled "RH ENG"), OFF, RAM, and RAM & DUMP positions. The switch controls the engine bleed-air shutoff valve from each engine, in each engine compressor hot-air line. Turning the switch to BOTH ENGINES opens both engine bleed-air shutoff valves simultaneously, to allow full flow

†Airplanes changed by T.O. 1T-39-758
‡Airplanes changed by T.O. 1T-39A-549

AIR CONDITIONING, PRESSURIZATION, AND ANTI-ICING SYSTEM CONTROLS



† Airplanes changed by T.O. 1T-39-758

Figure 4-2

compressor air in the air conditioning and pressurization system. Turning the switch to either LEFTHAND ENGINE or RIGHTHAND ENGINE shuts off the engine bleed-air shutoff valve from the nonselected engine.

NOTE The engine bleed-air shutoff valves are also pneumatically operated and will close any time the compressor discharge pressure drops below 4 psi.

- Single-engine compressor air is sufficient to maintain normal air conditioning and pressurization.

Turning the switch to OFF closes the engine bleed-air shutoff valves. Turning the switch to RAM closes the engine bleed-air shutoff valve for each engine and opens the emergency ram-air supply valve.

Caution With the cabin air selector switch at OFF or RAM, the air conditioning and pressurization system is inoperative and cabin pressure will bleed off. If the cabin altitude exceeds 10,000 feet, the cabin oxygen system will be automatically put into operation.

Turning the switch to RAM & DUMP opens the cabin pressure dump valve and emergency ram-air supply valve in addition to closing the engine bleed-air shutoff valves. Turning the switch to EMERGENCY PRESSURIZATION closes the engine bleed-air shutoff valve for each engine and opens the emergency pressurization valve for bleed air from the right-hand engine.

NOTE Crew and passenger comfort may be increased in the landing pattern by selecting OFF, RAM, or RAM & DUMP to prevent surges in the pressurization system as power changes are made.

CABIN TEMPERATURE SELECTOR SWITCH.

The four-position cabin temperature selector switch (figure 4-2) is on the center pedestal. The switch is powered by the ac essential bus and provides normal control of cabin and cockpit air temperature. The switch is operable only when the cabin air pressurization is on. When the switch is at the guarded AUTOMATIC (labeled "AUTO") position, a hot-air mixing valve is modulated to maintain the setting selected by a cabin air temperature rheostat through a temperature control box. With the switch at OFF, the automatic control system is inoperative and the valve remains in the position prevailing at the time the switch was turned to OFF. If the automatic temperature control system fails, or if manual control is desired, moving the temperature control switch to the spring-loaded MANUAL HOT (labeled "MAN HOT") or MANUAL COLD (labeled "MAN COLD") position opens or closes the hot-air mixing valve to produce a corresponding change in temperature. When manual control is used, the switch should be toggled momentarily and released to OFF. Sufficient time should be allowed between applications to minimize temperature overshoot.

NOTE With ac power failure, both the automatic and the manual control are inoperative.

CABIN AND COCKPIT AIR TEMPERATURE RHEOSTAT KNOB.

The cabin and cockpit air temperature rheostat knob (8, figure 1-5), on the center pedestal, is powered by the ac essential bus and sweeps from COLD to HOT. The knob may be positioned anyplace within this range and will automatically maintain a selected temperature of between 60°F and 80°F when the cabin air temperature selector switch is at AUTOMATIC. The cabin and cockpit air temperature rheostat is inoperative when the cabin air selector switch is at OFF, RAM, RAM & DUMP, or EMERGENCY PRESSURIZATION or when the cabin temperature selector switch is at any position other than AUTOMATIC.

COCKPIT AND CABIN COOLING AIR OUTLETS.

A cold air outlet (6, figure 1-3; 2, figure 1-4) is on each side of the cockpit above the consoles. In the cabin, a cold air outlet (figure 4-1) is within the reach of each passenger except at the crew-chief/passenger position.† These "eyeball" outlets are adjustable spherical units that can be positioned to direct cold air from the air conditioning system in any direction desired. A knurled ring around the opening can be rotated to regulate the volume of air. The ring is turned clockwise to close or counterclockwise to open.

COCKPIT AND CABIN PRESSURIZATION AIR OUTLETS.

Air outlets for cockpit heating and pressurization (figure 4-1) are behind the pilot's and copilot's seats and underneath each side of the instrument panel over the feet. In the cabin, conditioned air enters through flush outlets in the ceiling.

COCKPIT FLOOR AIR HANDLE.

Two manual cockpit floor air handles (4, figure 1-3; 4, figure 1-4), one above each console, increase or decrease the volume of conditioned air directed at the floor from the foot air outlets. (See figure 4-1.) The cockpit floor air handle can be positioned, as desired, to any point between ON and OFF.

NOTE When the selected handle is moved aft to ON, the air is directed to the floor through the foot air outlets. Moving the handle forward to OFF divides the air supply between the cockpit air outlets (behind the seats) and the foot air outlets.

FOOT-WARMER SWITCHES.‡

The three-position FOOTWARMER switch (figure 4-2) controls operation of the respective heater-blower. Placing the switch at HEATER energizes the heating element and operates the blower. Air from the floor area is drawn in and passed over the heating element which raises the temperature of the air 50°F. This warm air is discharged into the floor area of the respective pilot's feet. Placing the switch at BLOWER operates the blower only, to recirculate the air without heating. Placing the switch at OFF shuts off the respective heater-blower.

CABIN PRESSURE FAILURE WARNING LIGHT.

The "CABIN PRESS FAIL" red warning light (7, figure 1-26) is on the caution-warning light panel. If the cabin altitude exceeds 10,000 feet (provided the passenger's oxygen toggle valve is on) the oxygen system will be activated and the warning light will come on. If the cabin pressure is restored and the cabin altitude drops below 10,000 feet, the warning light will go out. Simultaneously with the warning light coming on, the oxygen warning horn will sound, the "WEAR OXYGEN MASK" and "NO SMOKING" compartment signs will illuminate, the cabin lights will come on, the cabin oxygen mask compartment doors will open, and oxygen will be available. Cabin altitude should be verified with the cabin altimeter and differential pressure indicator.

CABIN AIR OVERHEAT CAUTION LIGHT.

The "CABIN AIR OHEAT" amber caution light (7, figure 1-26) on the caution-warning light panel

† Airplanes changed by T.O. 1T-39A-549
‡ Airplanes changed by T.O. 1T-39-758

comes on if the temperature of the air in the distribution ducting upstream of the cabin and cockpit air outlets exceeds 265°F. Reduction of power on the right engine reduces the temperature of the incoming air and, when the temperature is reduced far enough, causes the light to go out.

PRESSURIZATION DUCT FAILURE CAUTION LIGHT.

The "PRESS DUCT FAIL" amber caution light (7, figure 1-26) on the caution-warning light panel comes on if the bleed-air pressure in the normal cabin pressurization duct falls below a preset pressure.

NOTE This light may come on during ground operation.

AFT FUSELAGE OVERHEAT CAUTION LIGHT.

Refer to "Aft Fuselage Overheat Detection System" in Section I.

CABIN ALTIMETER AND DIFFERENTIAL-PRESSURE INDICATOR.

The cabin altimeter and differential-pressure indicator (29, figure 1-2) is on the copilot's outboard instrument panel. The indicator is vented both to outside air pressure and to pressure within the cabin. It has two pointers, each traveling over a separate arc of calibrations. The "OUTSIDE" pointer, fixed to a rotating plate, shows flight pressure altitude. The "CABIN" pointer, fixed to a rotating band, shows both cabin altitude and differential pressure (between cabin and outside air) in pounds per square inch. The differential scale is visible through a cutout in the flight pressure altitude plate. After takeoff the "OUTSIDE" and "CABIN" pointers begin to move, until at 8000 feet (where the "CABIN" pointer will stop), a differential will start to exist. The "OUTSIDE" pointer will continue to rotate as the airplane altitude increases. As this pointer rotates with increasing altitude, more of the differential scale is exposed (read the highest exposed figure), until at 45,000 ("CABIN" pointer at 8000 feet), the scale will read 8.8 psi; then the "CABIN" pointer will begin to rise as the 8.8 psi pressure differential is maintained.

CABIN PRESSURE RATE-OF-CHANGE INDICATOR.

The rate of change in pressure altitude of the cockpit and cabin is indicated by the cabin pressure rate-of-change indicator (28, figure 1-2), on the copilot's outboard instrument panel. This indicator functions similarly to the flight vertical velocity indicator, but is vented only to pressure within the pressurized areas.

DOOR SEALS.

Pressurization for the seals of the entrance door and in-flight escape hatch (outer door) is provided by air from the engine compressors (figure 4-1) and is automatically controlled by a pressure regulator. Check valves in the system are designed to prevent reverse flow if an engine should fail, and to maintain pressure even if both engines should fail. A reservoir stores higher engine pressure for use if the engine pressure should drop below the required 25 psi. The pressure regulator incorporates a solenoid shutoff valve that is energized open when the weight of the airplane is off the landing gear, to permit pressurization of the seals. When the weight of the airplane is on the landing gear, the solenoid shutoff valve is de-energized to the spring-loaded closed position, shutting off pressurization air and dumping the seals. The seals for the ground escape hatch (over wing) and the pilot's side window are not included in the door seal system. The entrance door secondary seal, pilot's sliding window, and the ground escape hatch seal are of a dynamic type, subject only to pressure from within the cabin.

DOOR-OPEN CAUTION LIGHT.

Refer to "Entrance Door" in Section I.

NORMAL OPERATION OF AIR CONDITIONING AND PRESSURIZATION SYSTEM.

For normal operation of the air conditioning and pressurization system, proceed as follows:

1. Cabin temperature selector switch - AUTOMATIC.

   Move cabin temperature selector switch to AUTOMATIC and lower the guard.

2. Cabin air selector switch - BOTH ENGINES.

   Turn cabin air selector switch to BOTH ENGINES after both engines are started.

3. Cabin air temperature rheostat knob - As desired.

EMERGENCY OPERATION OF AIR CONDITIONING AND PRESSURIZATION SYSTEM.

Depressurization.

If depressurization of the cockpit is necessary, use the following procedure:

1. Oxygen masks - On and connect.
2. Pilots' oxygen diluter levers - 100% OXYGEN.
3. Passengers' oxygen toggle valve - Check on.
4. Passengers' oxygen masks - Check on.
5. Cabin air selector switch - RAM & DUMP.

NOTE Because of the controlled rate of dump, cabin pressure will require about 15 seconds to dump depending on the pressure differential.

6. Oxygen warning horn cutout button - Push.
7. Descend to below 25,000 feet.

   If pressurization cannot be regained, it may be necessary to descend depending upon remaining oxygen.

Loss of Pressurization.

Illumination of the "CABIN PRESS FAIL" warning light indicates a probable pressurization leak in the cabin and/or around the door seal. The cabin air selector switch should remain positioned at BOTH ENG, as selection of EMER PRESS will aggravate this condition. Maintain engine power settings as high as flight conditions will permit to ensure availability of maximum bleed air for pressurization.

Illumination of the "PRESS DUCT FAIL" caution light or simultaneous illumination of the "PRESS

DUCT FAIL" and "CABIN PRESS FAIL" lights indicates a loss of pressurization duct pressure, or a loss of both pressurization duct pressure and airplane pressurization. Under this condition, emergency pressurization is to be used. In case of a pressurization failure, proceed as follows:

1. OXYGEN MASKS—ON AND CONNECT.
2. Cabin air selector switch - EMER PRESS.
3. Rapid descent. (Refer to Section II.)
4. Pilots' oxygen regulator diluter levers - 100% OXYGEN.
5. Automatic manual override lever - Check OPEN.
6. Passengers' oxygen masks - Check on.
7. Oxygen warning horn cutout button - Push.
8. Descend to below 25,000 feet.

   If normal pressurization cannot be regained, it may be necessary to descend, depending, upon remaining oxygen.

9. Cabin air selector switch - RAM.

NOTE Pressurization loss may be indicated by the "PRESS DUCT FAIL" light coming on. If the duct failure has occurred in the aft fuselage, the "AFT FUS OHEAT" light may come on.

Excessive Cabin Temperature.

If the automatic temperature control system does not function properly and the cabin air overheat light comes on, proceed as follows:

1. Cabin temperature selector switch - MANUAL COLD.

   Lift guard on cabin temperature selector switch and momentarily hold switch at MANUAL COLD as often as necessary, and release to OFF.

If high temperature persists and it is desirable to lower cabin temperatures:

1. Cabin air selector switch - RAM.

   Turn cabin air selector switch to RAM to shut compressor bleed valves, and descend to a lower altitude not requiring pressurization.

ANTI-ICING SYSTEMS.

Anti-icing is accomplished either electrically or with final stage engine compressor air. (See figure 4-3.) The engine compressor air [about 500°F (260°C)] is used for anti-icing the engine air inlet duct lip, engine guide vanes, flow-straightener vanes, engine nose fairing, and heat and vent water separator downstream of the cooling turbine. Electrical heaters are used to prevent ice formation on the pitot heads, wing leading edges, and the ram-air intake in the dorsal fin. The forward windshield and side and overhead windows are also electrically heated for defogging, birdproofing, and anti-icing. Switches to control these systems are on a panel in the cockpit. An ice detector in the engine intake illuminates a caution light in the cockpit to warn of icing conditions. On some airplanes, † the engine ice detection system has been removed.

INLET DUCT AND GUIDE VANE ANTI-ICING SYSTEM.

The inlet duct lip, engine guide vanes, flow-straightener vanes, and engine nose fairing are protected from ice by hot engine compressor air. The compressor air passes through the inlet guide vane anti-ice valve and inlet anti-icing shutoff valve on each engine, which are controlled by the engine inlet anti-icing switch. An icing condition caution light comes on in the cockpit when ice is present. On some airplanes,† the engine ice detection system has been removed. On these airplanes, when outside air temperature falls below 32°F (0°C), refer to Section IX for "Cold-weather Procedures."

Caution For ground operational checks, do not operate the engine inlet anti-ice system for extended periods. The hot compressor bleed air used for engine inlet anti-icing may cause structural damage to the inlet duct while the airplane is on the ground.

Engine Inlet Anti-icing Switch.

The two-position engine inlet anti-icing switch (figure 4-2), on the anti-ice control panel, is powered by the dc essential bus. The switch positions are ON and OFF. Moving the engine inlet anti-icing switch to ON opens the inlet anti-icing shutoff valves (one on each engine) and inlet guide vane shutoff valve (one on each engine). Compressor air now flows to the leading edge of the engine inlet duct, flow-straightener vanes, bullet nose, and guide vanes of both engines. Moving the engine inlet anti-icing switch to OFF closes the inlet anti-icing shutoff valves and the inlet guide vane shutoff valves. With the switch in the OFF position, the engines receive no engine compressor bleed air for anti-icing.

Engine Anti-icing Failure Lights.

The "LH ENG DE-ICE FAIL" and "RH ENG DE-ICE FAIL" amber caution lights, (7, figure 1-26) are on the caution-warning light panel. The lights come on whenever either of the respective engine anti-ice valves do not correspond to the position

†Airplanes changed by T.O. 1T-39-767

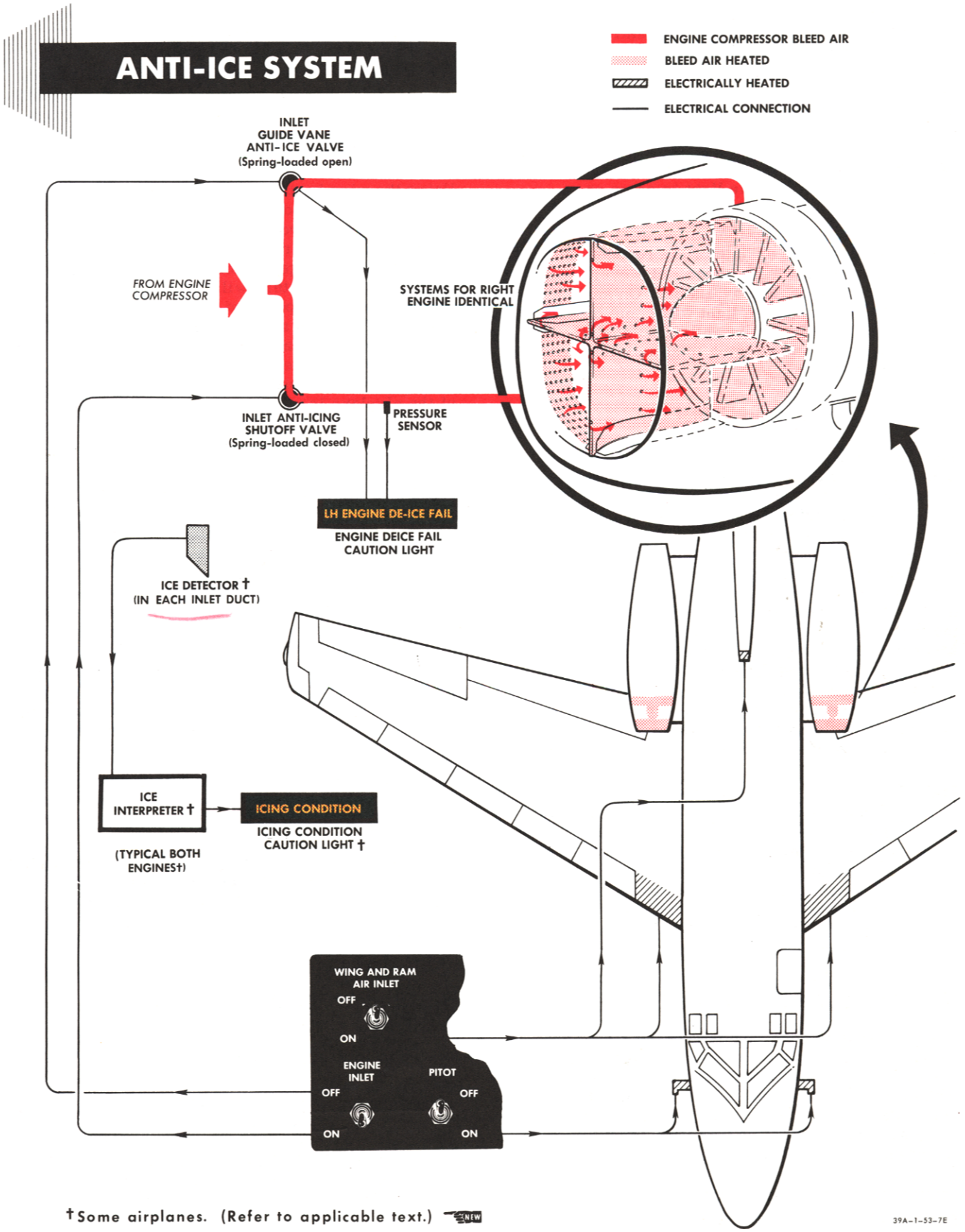

ANTI-ICE SYSTEM
ENGINE COMPRESSOR BLEED AIR
BLEED AIR HEATED
ELECTRICALLY HEATED
ELECTRICAL CONNECTION
INLET GUIDE VANE ANTI-ICE VALVE (Spring-loaded open)
FROM ENGINE COMPRESSOR
SYSTEMS FOR RIGHT ENGINE IDENTICAL
INLET ANTI-ICING SHUTOFF VALVE (Spring-loaded closed)
PRESSURE SENSOR
LH ENGINE DE-ICE FAIL
ENGINE DEICE FAIL CAUTION LIGHT
ICE DETECTOR †
(IN EACH INLET DUCT)
ICE INTERPRETER †
ICING CONDITION
ICING CONDITION CAUTION LIGHT †
(TYPICAL BOTH ENGINES†)
WING AND RAM AIR INLET
OFF
ON
ENGINE INLET
OFF
ON
PITOT
OFF
ON
†Some airplanes. (Refer to applicable text.)
NEW
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Figure 4-3

selected by the engine inlet anti-ice switch. If a light comes on with the engine inlet anti-ice switch at ON, this indicates that either or both of the respective engine anti-ice valves are closed. There is no corrective action for this condition; however, the airplane altitude and/or course should be changed to avoid further icing.

NOTE Insufficient bleed air at low-power settings may also cause the light to come on.

If a light comes on with the switch at OFF, this indicates that either or both of the respective engine anti-ice valves are open. However, normal engine anti-icing is still available. On some airplanes, † the respective light will come on only when the left or right inlet anti-icing shutoff valve fails to open when the engine inlet anti-icing switch is placed at ON.

Icing Condition Caution Light †

The "ICING CONDITION" amber caution light (7, figure 1-26) on the caution-warning light panel comes on whenever ice is detected in the inlet duct on either engine, regardless of the engine inlet anti-icing switch position. On some airplanes, † the light comes on whenever ice is detected in the right engine inlet duct only. Simultaneously with the light coming on, a heating element in the ice detector is energized to melt the ice that has formed on it. At the end of 14 to 19 seconds, the light goes out, the heating element is de-energized, and the ice detector is rearmed to detect another build-up of ice. It is possible, when icing conditions are being encountered, for the light to cycle on and off at intervals determined by the rapidity of ice build-up.

NOTE A check may be made of the icing condition caution light during engine coast-down. The light should come on momentarily during the latter part of the coast-down period, indicating that the system is operating. On some airplanes, § the ice detection system has been removed and the "ICING CONDITION" caution light has been deactivated.

WING AND RAM-AIR INLET ANTI-ICE SYSTEM.

The wing leading edge, inboard of the slats, and the ram-air inlet, in the dorsal fin, are protected from icing by an electrical heater which is controlled by a single switch in the cockpit. The system is designed as an anti-ice system and not as a deice system. It must be turned on before areas of known icing conditions (visible moisture) are entered. It should not be turned on unless the free air temperature is between +5°C and -5°C.

NOTE Refer to free air temperature correction chart in Part 1 of Appendix I or to the J201 computer in Part 7 for conversion from indicated air temperature to free air temperature.

Using the wing heaters to deice could cause chunks of ice to be ingested by the engines. The wing heaters are powered by the dc parallel bus; however, control power is obtained from the dc essential bus. Both dc generators must be operating before the wing heaters will function. The ram-air inlet heater is powered by the No. 1 dc secondary bus. There is no ice detector provided. However on some airplanes, ‡ the engine inlet duct ice detectors will serve to warn of icing conditions. The wing heaters will not operate when the weight of the airplane is on the landing gear. The dorsal fin ram-air inlet heater will operate on the ground if turned on, but only at a fraction of the full heat.

Wing and Ram-air Inlet Anti-ice Switch.

The two-position wing and ram-air inlet and anti-ice switch (figure 4-2), on the anti-ice control panel, is powered by the dc essential bus. This switch has an ON and OFF position. Moving the switch to ON electrically heats a "spray-mat" element on the leading edge of each wing, inboard of the slats, and on the ram-air inlet on the dorsal fin. Power to this switch for the wing leading edge heaters comes through the right and left engine master switches (which must be ON) and a ground lockout relay that is open while on the ground.

NOTE If either engine-driven dc generator fails, or is turned off, the entire wing and ram-air inlet and anti-ice system is inoperative.

The ram-air inlet heater will operate at a reduced rate on the ground if the switch is at ON. When air-borne, full heat will be available for the ram-air inlet heater. Moving the switch to OFF shuts off both the wing and ram-air inlet heaters.

SIDE AND OVERHEAD WINDSHIELD ANTI-ICE SYSTEM.

Side Windshield Anti-ice Switch.

The two-position side windshield anti-ice switch (figure 4-4), on the anti-ice control panel, is powered by the dc essential bus. Moving the switch to ON heats the pilot's sliding side window, copilot's side window, and both overhead windows with No. 1 dc secondary bus power. The windshield overheat

†AF59-2868 through -2872 and AF60-3478 through -3489
‡Airplanes not changed by T.O. 1T-39-767

§ Airplanes changed by T.O. 1T-39-767

caution light will also come on if these glass areas (except pilot's sliding side window) are overheated.

WINDSHIELD ANTI-ICING SYSTEM.

The two forward windshields are electrically heated by power provided from the two engine-driven, variable-frequency windshield ac generators and controlled by the dc essential bus through the windshield temperature control unit. Automatic heating of both windshields can be obtained by a rotary two-position switch mounted on the anti-ice control panel. Caution lights warn the pilot in case of generator failure and generator and windshield overheat conditions. A forward windshield generator switch is provided for each generator and can be used to take the affected generator off the line in case of a generator malfunction. Both switches are directly below the rotary windshield anti-ice switch.

NOTE If either engine-driven dc generator fails, or is turned off, the respective windshield ac generator will be inoperative.

For normal operation of the system, the dual-channel control unit regulates individual heating of each windshield by its respective generator. When a generator is first turned on, the control unit restricts windshield heating for the first 30 seconds to a slow rate. This protection is provided to prevent thermal shock if the windshield glass is extremely cold at the start of the heating cycle. After the slow-rate period ends, fast heating is provided until windshield temperature reaches the approximate mid-point of the controlled band. Meanwhile, when the temperature reaches the low end of the controlled band, the out-of-temperature range trigger circuit is armed. The function of this circuit is to take the generator off the line whenever windshield temperature goes outside the controlled band. If the temperature of one windshield does go outside the controlled band, the out-of-temperature range trigger circuit takes the associated generator off the line and the control unit places both windshield heaters in parallel. The remaining operative generator then heats both windshields. However, precise temperature control will be maintained only for the windshield normally heated by the generator in use, since only one channel of the control unit will be operating.

It is important to note that the out-of-temperature range trigger circuits are not armed until windshield temperature enters the controlled band.

Therefore, should the system be turned off for any reason, sufficient time should elapse (2 to 3 minutes) before it is turned on again, to allow the windshields to cool to a temperature below the controlled band. Turning a defective control unit back on with windshield temperature above the controlled band could result in overheating the windshields without arming the protective circuits.

Forward Windshield Anti-ice Switch.

The forward windshield anti-ice selector switch (figure 4-4) is a rotary-type switch mounted on the anti-ice control panel. The switch has two positions: OFF and ON. Moving the switch to ON permits the windshield temperature control unit to sense and control the temperature of both windshields, and the switch should remain in this position during flight. During single-generator operation, with the switch at ON, electrical power will be distributed to both windshields. The OFF position shuts off all power to the windshield heaters.

CAUTION

Turn the windshield anti-icing system on before take-off, to ensure birdproofing of the windshields.

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Forward Windshield AC Generator Switches.

The two toggle-type forward windshield ac generator switches (figure 4-4), mounted directly below the rotary windshield anti-ice switch, have ON and OFF positions. Moving the switches to the ON position permits ac power from both generators to energize the windshield heating system. Both switches should be turned on after engine start. Should a malfunction occur in either generator circuit, the affected generator should be disabled by moving the respective generator switch to the OFF position. Windshield heating of the left and right windshields can be accomplished by single generator operation.

Windshield Overheat Caution Light.

The "WINDSHIELD OHEAT" amber caution light (7, figure 1-26) on the caution-warning light panel

WINDSHIELD HEATING

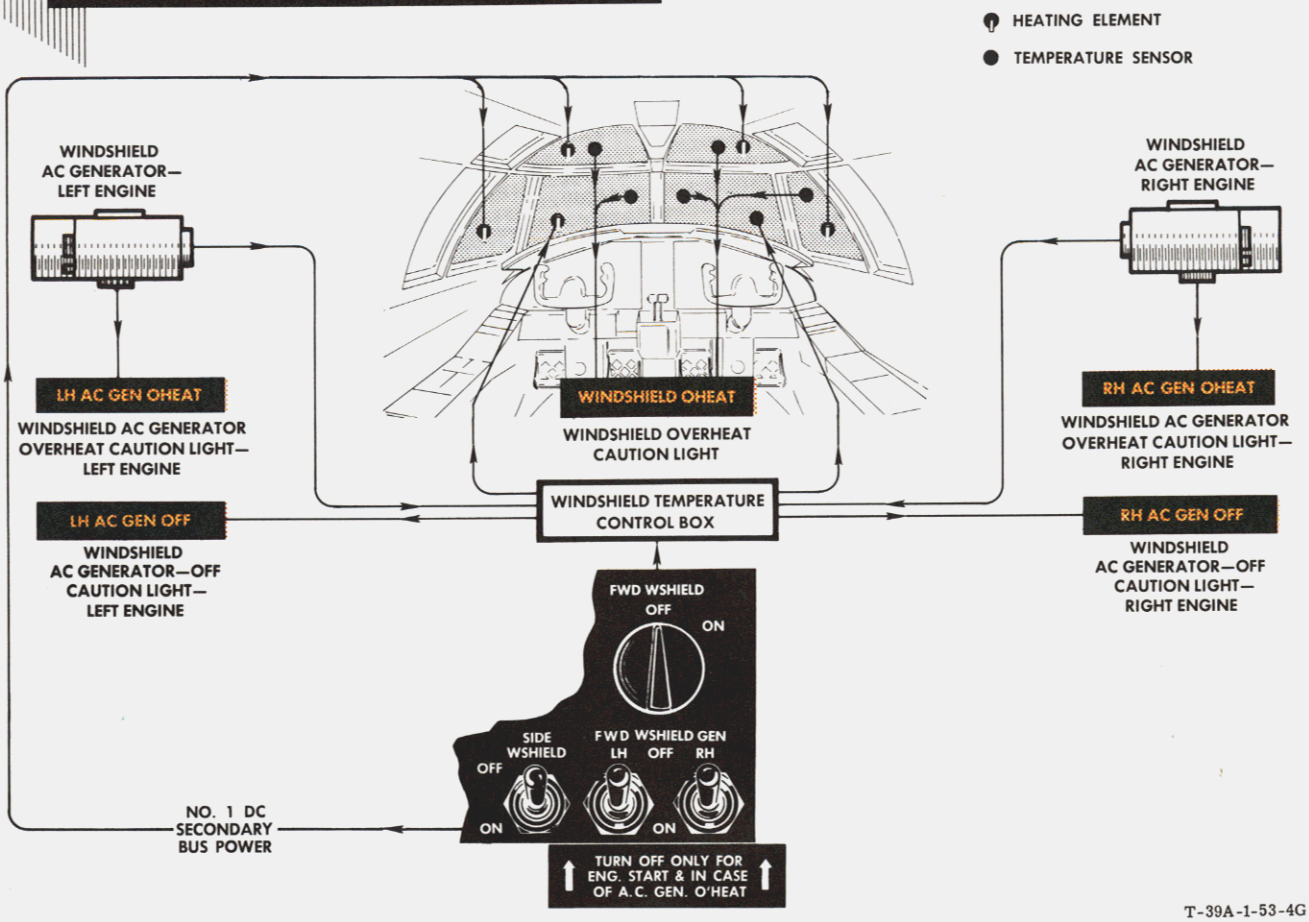

Figure 4-4

comes on whenever an overheat condition is sensed in either of the two forward windshields, the co-pilot's side window, or the overhead windows. There is no overheat indication for the pilot's sliding window.

NOTE If the windshields have been exposed to solar heating, the windshield overheat caution light may come on immediately when the windshield anti-ice switch or side windshield anti-ice switch is placed at ON. If this occurs, the affected system should be turned off. Periodically during flight, the affected system should be turned on, and left on only when the light remains out.

- If the light comes on in flight, this indicates overheating of one or more windshields. An attempt should be made to isolate the malfunction. If it can be isolated by alternately shutting off the heat to the side, then forward windshields, the affected system should be left off until the malfunction is corrected.
- The windshields are birdproofed at altitudes below 10,000 feet at less than 250 knots true airspeed.

AC Generator-off Caution Lights.

The "RH AC GEN OFF" and "LH AC GEN OFF" amber caution lights (7, figure 1-26) are on the caution-warning light panel. After the out-of-temperature range trigger circuit has been armed, these lights come on whenever the temperature of the respective windshield has gone outside the temperature control band. The lights will also come on if the respective ac generator switch is at OFF, if the respective ac generator has failed, or when the respective dc generator is off the line. When the ac generator is turned off in flight, the light will not come on until the windshield temperature has dropped below the temperature control band. **Except for one condition, when a light comes on, the respective forward windshield ac generator switch should be placed at OFF.**

WINDSHIELD ANTI-ICING SYSTEM FAILURES

CONDITION	CAUSE	CORRECTIVE ACTION
Windshield overheat caution light on immediately when rotary forward windshield anti-ice switch or side windshield anti-ice switch is placed at **ON**.	Solar heating	Place affected system switch at **OFF**. Periodically turn affected system on. Leave on only when light remains out.
Windshield overheat caution light comes on in flight.	Windshield, copilot's side window, or overhead windows overheating.	Turn rotary forward windshield anti-ice switch **OFF**. If light goes out immediately, no further action is necessary. If light stays on, turn side windshield switch **OFF**. When light goes out, turn rotary forward windshield anti-ice switch **ON**.
Left or right ac generator-off caution light on immediately after rotary forward windshield anti-ice switch is turned **ON**.	AC generator or system failure or possible solar heating.	Turn rotary forward windshield anti-ice switch **OFF** and investigate.
Left or right ac generator-off caution light on during taxi.	Respective dc generator off the line, respective windshield temperature outside the temperature control band, or respective ac generator failed.	Reset dc generator. During heavy precipitation and low ambient temperatures, cycle rotary forward windshield anti-ice switch **OFF** momentarily, then **ON**. Otherwise, turn respective ac generator off.
Left or right ac generator-off caution light comes on in cruising flight.	One light does not mean that windshield heating is lost unless heater element has failed.	Check heat by touch. Leave rotary forward windshield anti-ice switch **ON**. Investigate after landing.
Left or right ac generator-off caution light comes on in low rpm descent.	AC generators limited in output below 58 percent engine rpm.	Reset by turning rotary forward windshield anti-ice switch **OFF**, then back to **ON**.
Left or right ac generator overheat caution light comes on.	AC generator is overheating.	Turn affected ac generator off.
Distortion or bubbling of either windshield.	Windshield heat control has failed.	Turn rotary forward windshield anti-ice switch **OFF** and leave **OFF**.

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Figure 4-5

The one exception is during flight operations conducted under heavy precipitation at low ambient temperatures. This condition imposes the greatest thermal demand on the windshield anti-ice system, and ac generator output may not be able to maintain windshield temperatures within the control band. As the temperature in any one windshield goes below the low-temperature trigger circuit, the ac generator for that windshield is automatically taken off the line, the respective ac generator-off caution light comes on, and the power requirements are transferred to the other ac generator. The remaining ac generator, now supplying power for both windshields, cannot maintain its windshield temperature within the control band. Temperatures below the low-temperature trigger circuit are sensed, and the remaining ac generator is taken off the line, with its ac generator-off caution light coming on almost simultaneously with the first. When this condition occurs, the windshield anti-ice system should be reactivated by placing the rotary forward windshield anti-ice switch at OFF, momentarily, and then at ON. Windshield heat will be below the control band until ambient conditions allow temperature rise, at which time the out-of-temperature trigger circuit will become armed.

AC Generator Overheat Caution Lights.

The "RH AC GEN OHEAT" and "LH AC GEN OHEAT" amber caution lights (7, figure 1-26) on the caution-warning light panel come on when the respective windshield ac generator is overheated. If either overheat caution light comes on during flight, the affected generator should be turned off.

Windshield Anti-icing System Failures.

Figure 4-5 lists various failure indications for the side and overhead windshield anti-ice and windshield anti-icing systems, probable causes of the failures, and corrective action to be taken.

PITOT HEATER.

Each pitot head is electrically heated by a different electrical bus. The right pitot head is heated by the No. 2 dc secondary bus, and the left pitot head is heated by the dc essential bus.

Pitot Anti-ice Switch.

The pitot anti-ice switch (figure 4-2), on the anti-ice control panel, has ON and OFF positions. When the switch is moved to ON, power from the separate busses is supplied to the pitot heads. Moving the switch to OFF turns off the power to the pitot head heaters.

Caution The pitot heaters must not be operated continuously while the airplane is on the ground.

CAUTION

Turn on pitot heat just before take-off, when icing conditions are suspected.

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DEICING SYSTEM.

FUEL HEATER SYSTEM.

Ice is removed from the fuel filter on each engine by heating the fuel with hot engine compressor air from its respective engine before it gets to the fuel filter. The heated air supply is controlled by a motor-actuated valve, on each engine, that is powered by the dc essential bus. A switch in the cockpit operates the valve on each engine simultaneously and illuminates a fuel heater caution light for each when it is open. A drop in pressure of 7 to 8 psi across the fuel filter will cause the fuel filter blocked caution light to come on, indicating the fuel heater should be operated.

Fuel Heater Switch.

The two-position fuel heater switch (figure 4-2), on the anti-ice control panel, is powered by the dc essential bus and has ON and OFF positions. When the switch is moved to ON, the fuel heat valve in the engine compressor bleed-air duct of each engine opens and directs hot air through the fuel heaters. Also, a fuel heater caution light comes on for each valve as it is opened. Moving the switch to OFF closes these valves, and the caution lights go out. There is no way to select these valves individually.

Fuel Heater Caution Light.

The "RH FUEL HEAT ON" and "LH FUEL HEAT ON" amber caution lights (7, figure 1-26) on the caution-warning light panel come on when their respective fuel heat valve is open, and will remain on until that valve is closed.

NOTE If a fuel heater valve fails in the open position, normal flight can be maintained. However, corrective action must be taken before the next flight.

Fuel Filter Blocked Caution Light.

Refer to "Engine Fuel System" in Section I.

Ice-check Light Switch.

Refer to "Lighting Equipment" in this section.

OPERATION OF FUEL HEATER.

During flight in subfreezing temperature, or after "cold soak" of the fuel and airplane at altitude, icing conditions may exist in the fuel system. The fuel heat should be operated one minute each 30 minutes during flight, and just before take-off and landing. This procedure may be omitted if it is known that the fuel on board does contain a suitable anti-icing additive.

Caution Do not take off with fuel heater on. If fuel heater use is necessary before take-off, its operation should be completed before take-off.

When the "FUEL FILTER BLOCK" caution light comes on or fuel flow fluctuations are noted, proceed as follows:

1. Fuel heater switch - ON.

   Move the fuel heater switch to ON, and check that both fuel heater caution lights come on.

2. Fuel heater switch - OFF.

   After heat has been used for one minute, move the fuel heater switch to OFF, and check that both fuel heater caution lights go out.

3. Fuel filter blocked caution light - Check out.

   If the fuel filter blocked caution light remains on after one minute of heater operation, the filters may be blocked by foreign material other than ice.

Caution Operate the heater one minute only, during each 30 minutes for the remainder of the flight. With the fuel heater switch ON, allow heater to operate for one full minute.

- Prolonged and unnecessary use of the fuel heater speeds up fuel nozzle coking. Excessive use of the fuel heater will also cause engine oil overheat.

Condensation of water droplets in the burner pressure sensing line may cause a hung engine deceleration or high engine idle condition at altitudes above 20,000 feet due to ice blockage of the line or ice restriction of burner pressure bellows movement. The resulting false burner pressure bellows position can usually be corrected by fuel heater operation for one minute. If heater operation appears to help, but does not completely correct the condition in one minute, heater operation for one-minute periods may be repeated until the condition is corrected or no further improvement results. Do not operate the heater continuously.

OPERATION OF ANTI-ICING SYSTEM.

Before all take-offs:

1. Side windshield anti-ice switch - ON.
2. Forward windshield ac generator switches - ON.
3. Forward windshield anti-ice switch - ON.
4. Fuel heater switch - As required.
5. Pitot anti-ice switch - ON (if required).

   Use before entering known icing conditions or at any time when flying through visible moisture.

6. Wing and ram-air inlet anti-ice switch - ON (if required).

   Use before take-off and or in flight before entering known icing conditions (visible moisture) when the free air temperature is between +5°C and -5°C. It should not be turned on if any significant ice build-up is observed on the leading edge of the wing.

NOTE Refer to free air temperature correction in Part 1 of Appendix I or to the J201 computer in Part 7 for conversion from indicated air temperature to free air temperature.

- During night operations, use ice-check lights to check for wing icing.

7. Engine inlet anti-ice switch - ON (if required).

   Use before take-off and/or in flight if the free air temperature is between +5°C and -20°C with visible moisture present. It should also be turned on if any accumulation of ice is noted on the airplane or if the "ICING CONDITION" caution light is on.

OXYGEN SYSTEM.

The pilots' and passengers' gaseous oxygen system is supplied by a single lightweight oxygen cylinder in the oxygen compartment. (See figure 4-6.) Fully serviced, this cylinder contains about 1800 psi. The cylinder is serviced through a valve behind a hinged door on the lower left side of the oxygen compartment. (See figure 1-31 for servicing information.) An electrical gage in the cockpit indicates the cylinder pressure. The cylinder pressure is reduced to approximately 350 psi by a pressure reducer in the oxygen compartment before entering the cockpit, to keep high pressure oxygen out of the cockpit. The pilot and copilot have individual oxygen regulators at their respective consoles. Cabin oxygen is supplied through demand-type regulators to an oxygen compartment, with a dropout oxygen mask, above each passenger position. The pilot and copilot must furnish their own oxygen masks and connect them to the oxygen hose stowed in the aft portion of the console. The cabin oxygen system is put into operation automatically if the cabin altitude exceeds 10,000 feet (provided the passengers' oxygen toggle valve is ON). At this time, the "WEAR OXYGEN MASK" and "NO SMOKING" signs come on, a cabin pressure failure warning light comes on, the oxygen warning horn sounds, the cabin lights come on, the cabin air breathing valves close, and the cabin oxygen mask compartment doors (figure 4-7) open to expose the cabin occupants' oxygen masks. When a cabin occupant's oxygen mask and hose is removed from the compartment, an "in-use" valve in the mask hose for the oxygen

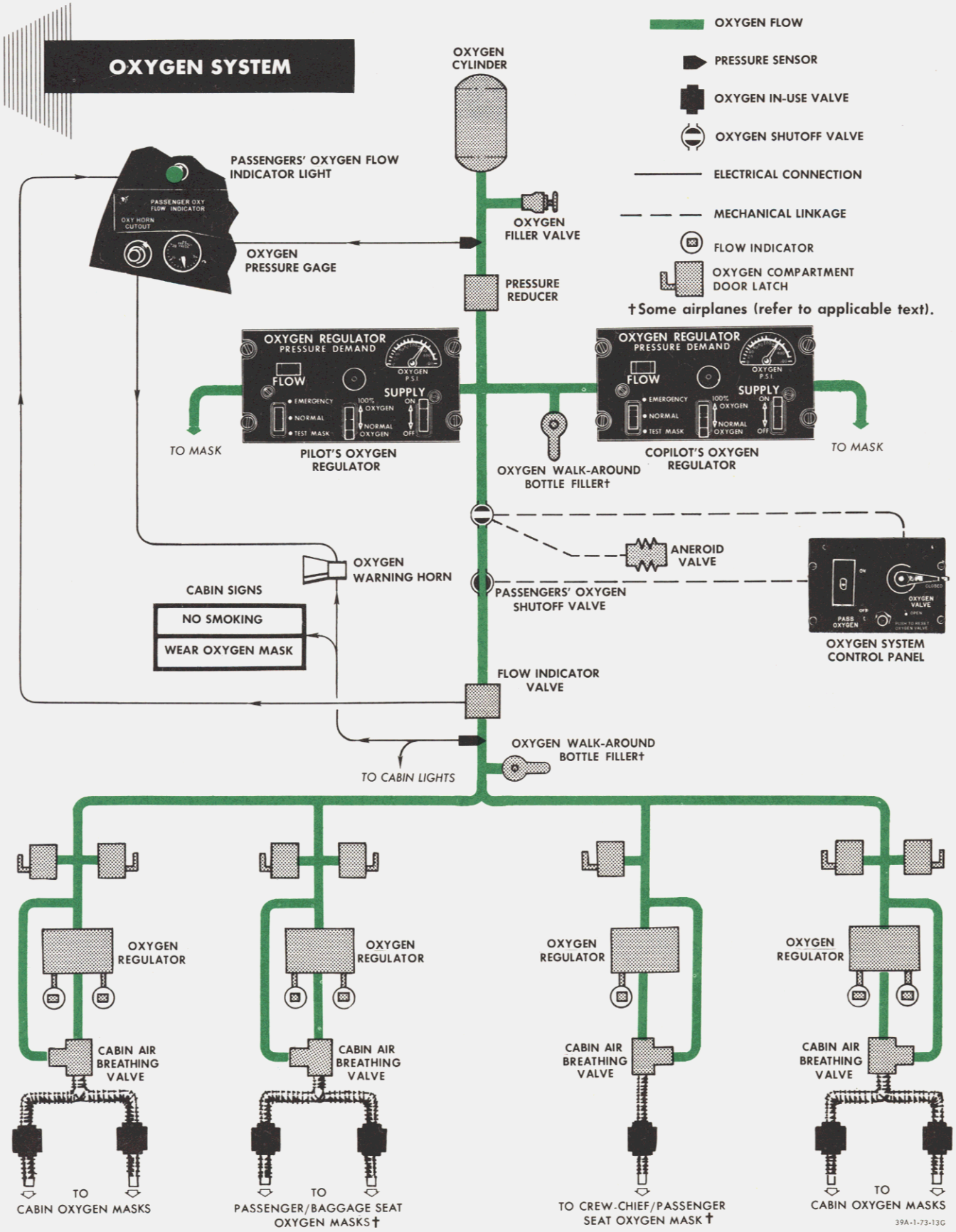
OXYGEN SYSTEM
OXYGEN FLOW
PRESSURE SENSOR
OXYGEN IN-USE VALVE
OXYGEN SHUTOFF VALVE
ELECTRICAL CONNECTION
MECHANICAL LINKAGE
FLOW INDICATOR
OXYGEN COMPARTMENT DOOR LATCH
†Some airplanes (refer to applicable text).
OXYGEN CYLINDER
PASSENGERS' OXYGEN FLOW INDICATOR LIGHT
PASSENGER OXY FLOW INDICATOR
OXY HORN CUTOUT
OXYGEN PRESSURE GAGE
OXYGEN FILLER VALVE
PRESSURE REDUCER
OXYGEN REGULATOR
PRESSURE DEMAND
FLOW
OXYGEN P.S.I.
SUPPLY
EMERGENCY
NORMAL
TEST MASK
100% OXYGEN
NORMAL OXYGEN
ON
OFF
TO MASK
PILOT'S OXYGEN REGULATOR
OXYGEN WALK-AROUND BOTTLE FILLER†
COPILOT'S OXYGEN REGULATOR
TO MASK
ANEROID VALVE
OXYGEN WARNING HORN
PASSENGERS' OXYGEN SHUTOFF VALVE
OXYGEN VALVE
PASS OXYGEN
OXYGEN SYSTEM CONTROL PANEL
CABIN SIGNS
NO SMOKING
WEAR OXYGEN MASK
FLOW INDICATOR VALVE
OXYGEN WALK-AROUND BOTTLE FILLER†
TO CABIN LIGHTS
OXYGEN REGULATOR
CABIN AIR BREATHING VALVE
TO CABIN OXYGEN MASKS
TO PASSENGER/BAGGAGE SEAT OXYGEN MASKS†
TO CREW-CHIEF/PASSENGER SEAT OXYGEN MASK†
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Figure 4-6

OXYGEN SYSTEM CONTROLS

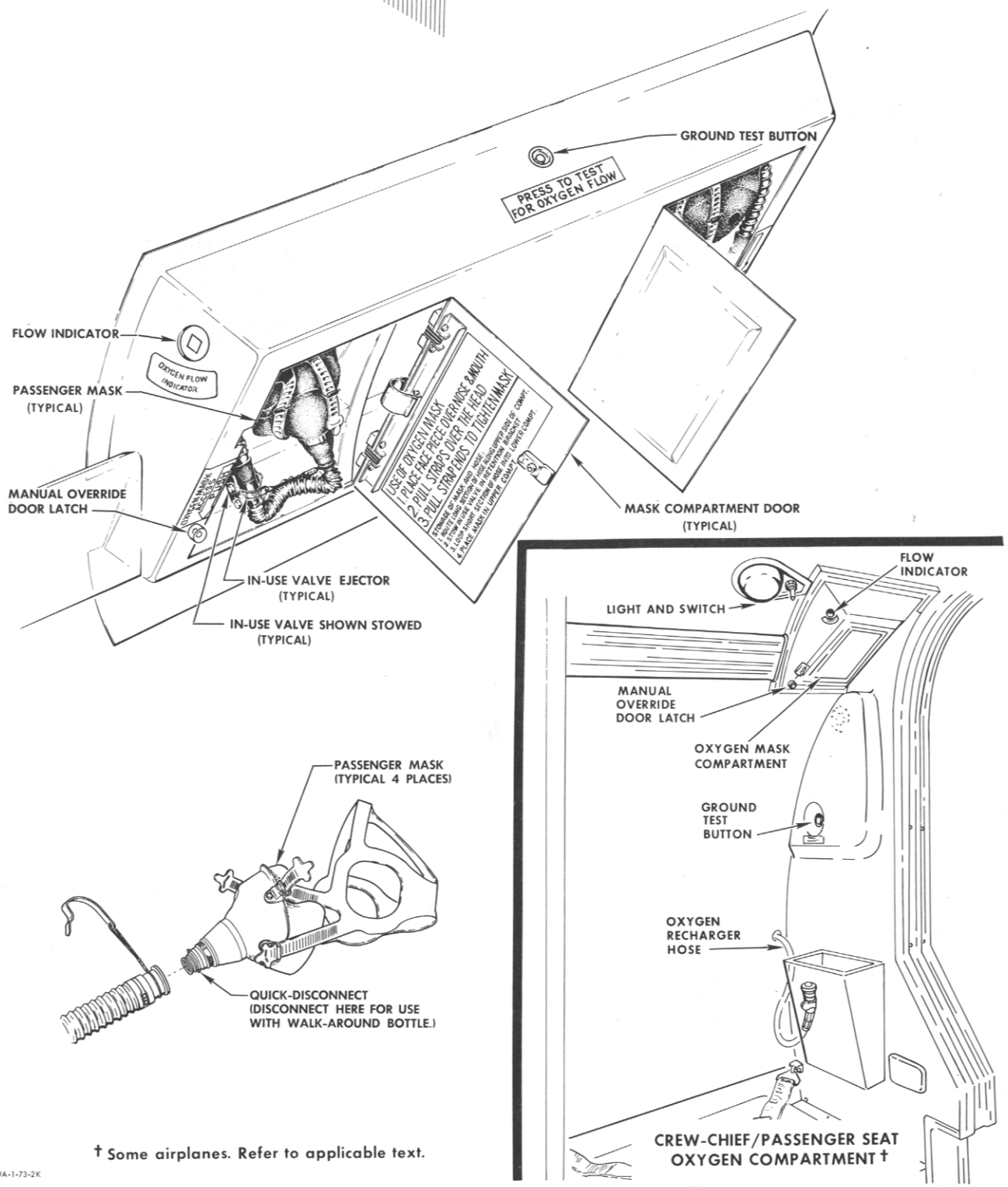
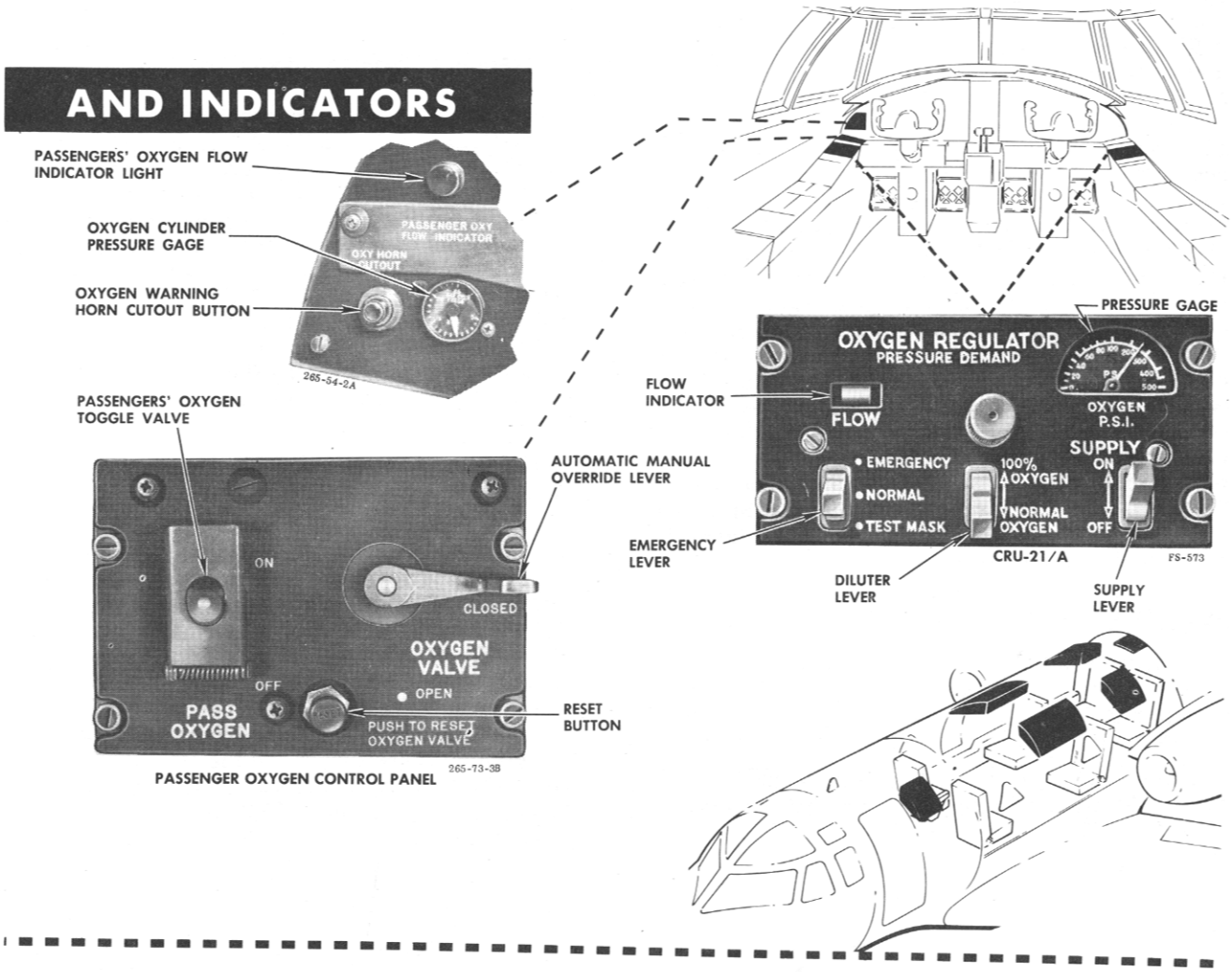
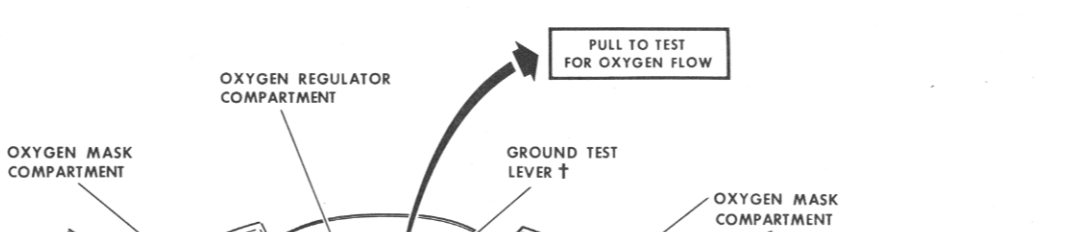


Figure 4-7

AND INDICATORS





mask opens and supplies oxygen to the mask. An ejector and a lanyard attached to the mask force the "in-use" valve out of the clip to ensure operation. A flow indicator is provided on the end of each mask compartment. The passengers' regulators supply a proper mixture of oxygen and air at all cabin altitudes up to 28,000 feet on diluter demand. At 28,000 to 30,000 feet, 100 percent oxygen is supplied upon demand. At 30,000 feet and above, 100 percent oxygen is supplied under pressure to the user. A ground-test push button or lever for checking oxygen flow through the oxygen regulator is on each regulator, and while actuated will provide 100 percent oxygen to the passengers' masks. Oxygen use in the cabin is shown by an indicator light in the cockpit. If no cabin occupants are carried, the oxygen can be shut off to the cabin by a toggle valve in the cockpit. (See figure 4-8 for oxygen duration.) A walk-around bottle is in the coat compartment or, on some airplanes,† on the forward partition of the baggage compartment under the shelf. The recharger hose is stowed in the co-pilot's mask storage box or, on some airplanes,† in the coat compartment.

OXYGEN SYSTEM CONTROL PANEL.

The oxygen system control panel (figure 4-7), on the left console, controls the cabin oxygen. The control panel has a lever and a reset button which are used during ground-checking of the oxygen system or for manual operation of the cabin oxygen system.

Passengers' Oxygen Toggle Valve.

A manual two-position passengers' oxygen toggle valve (figure 4-7), on the oxygen control panel, has ON and OFF positions and is guarded to ON. If the toggle is at OFF (guard up), move the toggle to ON by pulling the toggle out and up over a slight hump. This opens the passengers' oxygen valve, and releasing the toggle and lowering the guard safeties the toggle at ON. Lifting the guard and pulling the toggle out and down to OFF shuts off the oxygen to the cabin. (The guard remains raised to act as a warning flag.) The toggle must be at ON when passengers are carried.

Automatic Manual Override Lever and Reset Button.

The manual override lever (figure 4-7) for the cabin automatic oxygen system is on the oxygen control panel and there is also a reset button below the lever. The lever is normally left at CLOSED. The lever moves to OPEN automatically when the cabin altitude exceeds 10,000 feet. For ground-checking of the cabin oxygen system, and for making oxygen available to the passengers at the pilot's discretion, move the lever to OPEN. After the system is checked, move the lever firmly to CLOSED until it clicks, and push the reset button. (There is a distinct spring resist-

†Airplanes changed by T.O. 1T-39A-549
‡AF62-4491 and all later airplanes not changed by T.O. 1T-39A-549

OXYGEN DURATION

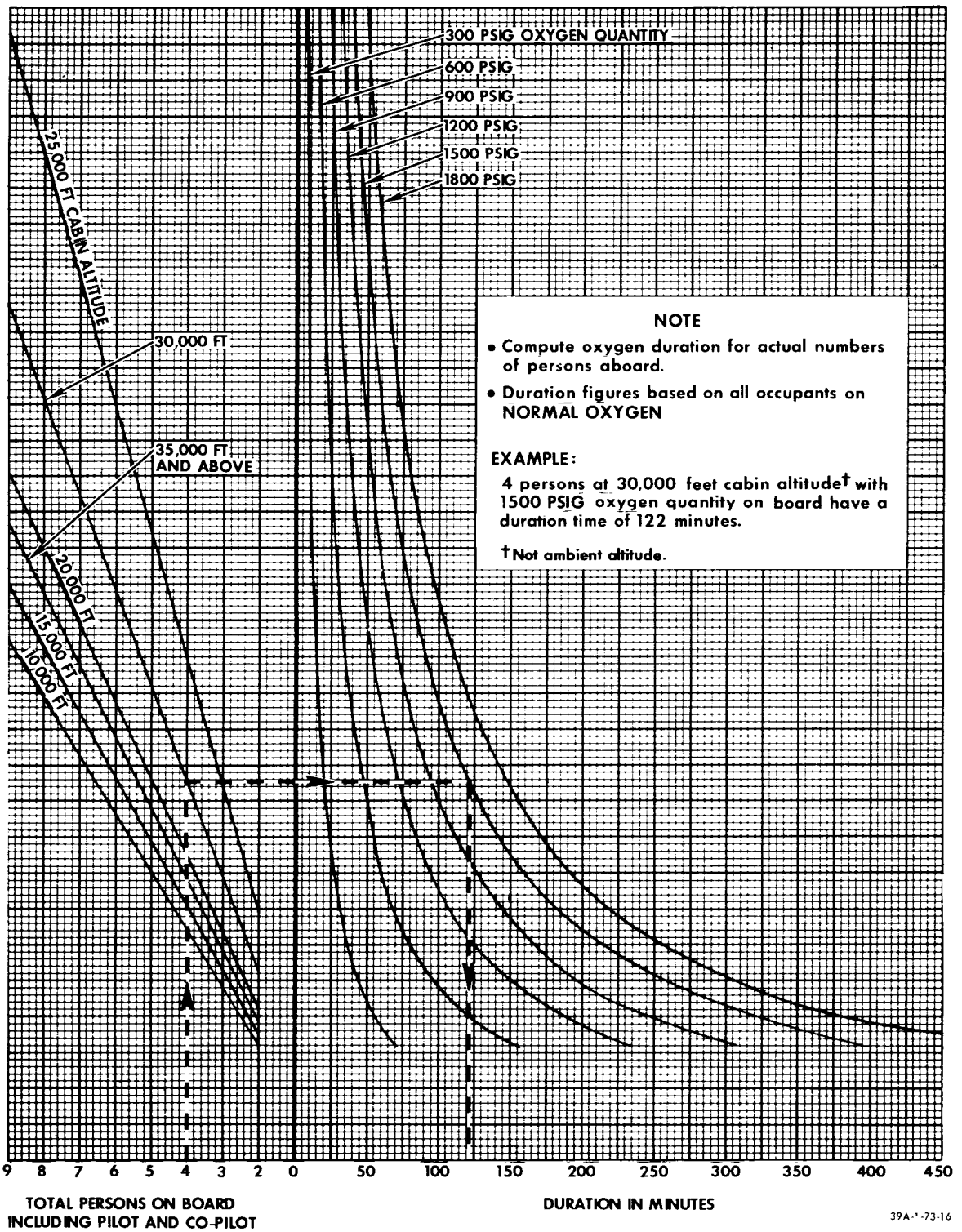


Figure 4-8

ance to overcome, to move the lever to CLOSED.) As a safety feature, when the cabin oxygen system has been automatically put into operation at altitude, the lever will not stay at CLOSED if put there inadvertently.

OXYGEN CYLINDER PRESSURE GAGE.

The oxygen cylinder pressure gage (70, figure 1-2), on the pilot's outboard instrument panel, is powered by the No. 2 26-volt ac bus. This gage indicates the oxygen cylinder pressure in psi before it is reduced to using pressure.

PASSENGERS' OXYGEN FLOW INDICATOR LIGHT.

The passengers' oxygen flow green indicator light on the pilot's outboard instrument panel (1, figure 1-2) comes on when the passengers' oxygen is flowing, and may blink during the breathing cycle.

OXYGEN WARNING HORN.

The oxygen warning horn is mounted on the rear bulkhead of the cabin and is powered by the dc essential bus when oxygen pressure in the lines operates a pressure switch. The warning horn will sound if the cabin altitude exceeds 10,000 feet (provided the passengers' oxygen toggle valve is ON) and, at the same time, the "WEAR OXYGEN MASK" and "NO SMOKING" signs come on, cabin lights come on, and the mask compartment doors open. An oxygen warning horn cutout button is used to silence the horn.

Oxygen Warning Horn Cutout Button.

The oxygen warning horn cutout button (71, figure 1-2), on the pilot's outboard instrument panel, is powered by the dc essential bus. Pressing this button momentarily when the oxygen warning horn sounds will stop the electrical power to the horn.

"WEAR OXYGEN MASK" COMPARTMENT SIGN.

Two "WEAR OXYGEN MASK" compartment signs are in the cabin. When these signs come on, one is readable by the forward-facing occupants and the other by the aft-facing occupants. Each sign is part of a three-part unit. The compartment sign is automatically illuminated by dc essential bus power when the cabin altitude exceeds 10,000 feet (provided the passengers' oxygen toggle valve is ON). There is no switch to control this compartment sign. The "NO SMOKING" compartment sign comes on simultaneously with the "WEAR OXYGEN MASK" compartment sign.

OXYGEN REGULATORS - PILOTS'.

The pilot and copilot each have a CRU-21/A oxygen regulator (figure 4-7) on their respective consoles. The regulator is a pressure-demand type that mixes cabin air with oxygen in varying amounts according to altitude, and makes available a quantity of the mixture each time the user inhales. At high altitudes, the regulator supplies oxygen at continuous positive pressure. The delivery pressure automatically changes with cabin altitude. Each oxygen regulator control panel includes an oxygen pressure gage, a flow indicator, and control levers.

NOTE Above 30,000 feet cabin altitude, a vibration or wheezing sound may sometimes be noticed in the mask. This noise is a normal characteristic of regulator operation and should be overlooked.

Emergency Lever.

The red emergency lever (figure 4-7) should be at NORMAL (center position) at all times, unless an unscheduled oxygen pressure increase is desired. Moving the lever to EMERGENCY provides continuous positive pressure to the mask. When the lever is held at TEST MASK, oxygen at positive pressure is provided to test the pilots' masks for leaks.

CAUTION

When positive pressures are required, it is mandatory that the oxygen mask be well fitted to the face. Unless special precautions are taken to ensure that there is no leakage, continued use of positive pressure under these conditions will result in the rapid depletion of the oxygen supply.

T-39A-1-0-20

Diluter Lever.

The white diluter lever (figure 4-7) should be at NORMAL OXYGEN for normal oxygen use, or at 100% OXYGEN for emergency use. With the lever at NORMAL OXYGEN, the regulator supplies a mixture of air and oxygen up to about 30,000 feet,

which is equivalent to normal breathing at sea level. Above 30,000 feet, 100 percent oxygen is supplied on either setting. These operating characteristics are related to the cabin altitude only.

Supply Lever.

The green supply lever (figure 4-7) is safety-wired at ON. It also has an OFF position.

Pressure Gage and Flow Indicator.

The pressure gage (figure 4-7) shows oxygen system pressure available at the regulators. The flow indicator (blinker) consists of an oblong opening which shows black and white alternately during breathing cycle.

OXYGEN REGULATORS - CABIN.

Pressure-demand oxygen regulators supply oxygen to the cabin occupants. One regulator is on each side of the cabin inside the dual oxygen mask compartment. Each regulator supplies two oxygen masks. On some airplanes,† an oxygen regulator over the two-passenger/baggage seat supplies two oxygen masks, and an oxygen regulator on the forward partition of the crew-chief/passenger seat supplies one oxygen mask. The regulator over the two-passenger/baggage seat has a ground test lever, and the other regulators have a ground test button. All regulators have an oxygen flow indicator.

Oxygen Flow Indicators.

An oxygen flow indicator (figure 4-7), on each oxygen mask compartment, actuates during the breathing cycle to indicate the flow of oxygen to each passenger.

Ground Test Button or Lever.

A ground test lever for the two-passenger/baggage seat oxygen regulator† and a ground test button for each of the other regulators (figure 4-7) permit ground testing of the oxygen regulator and cabin occupants' oxygen masks when passenger oxygen is on.

OXYGEN MASKS - CABIN.

A pressure-demand oxygen mask above each seat is provided for each occupant. Each passenger oxygen mask is enclosed in a compartment (figure 4-7), covered by a door, which houses the masks until they are needed. When oxygen is required, these doors open automatically and the masks are exposed. Removing the mask and "in-use" valve from the compartment starts oxygen flow to the mask. Replacing the mask and returning the "in-use" valve to its clip stops oxygen flow to the mask.

NOTE Before the mask compartment doors can be closed, oxygen pressure must be bled from the system. This can be accomplished by resetting the automatic manual override lever on the pilot's console and pushing the ground test button or pulling the ground test lever at the two-passenger/baggage seat position.†

- The door should not be closed unless the "in-use" valve is in its clip properly and the mask is properly stowed.

DEMONSTRATION OXYGEN MASK.

A demonstration oxygen mask and stowage hook, in the coat compartment or baggage compartment,† is provided to permit showing the passengers the proper method of donning the mask. This mask is not connected to the oxygen system and is used only for demonstration purposes.

OXYGEN SYSTEM PREFLIGHT CHECK - PILOT'S.

Before take-off, the oxygen system should be checked as follows:

NOTE Any reference to the oxygen regulator applies to both pilot's and copilot's oxygen regulator.

1. Oxygen regulator supply levers - ON.

   Check that oxygen regulator supply levers are safetied at ON.

2. Oxygen regulator pressure gage - Check.

   Check oxygen regulator pressure gage indicator at 350 (±50) psi.

3. Oxygen regulator diluter levers - 100% OXYGEN.

4. Oxygen regulator - Blow-check.

   Blow gently into end of oxygen regulator hose as during normal exhalation. There should be resistance to blowing. Little or no resistance to blowing indicates a leak or faulty operation.

5. Oxygen regulator diluter lever - NORMAL OXYGEN.

6. Oxygen regulator emergency levers - Test to check flow indicator.

7. Oxygen system automatic manual override lever - CLOSED.

8. Passengers' oxygen toggle valve - ON.

9. Oxygen cylinder pressure gage - Check.

   Check oxygen cylinder pressure gage for adequate oxygen for the mission. (Fully charged condition is about 1800 psi at 70° F.)

10. Mask - Connect as required.

NORMAL OPERATION OF OXYGEN SYSTEM.

NOTE Any reference to the oxygen regulator

†Airplanes changed by T.O. 1T-39A-549

applies to both the pilot's and the copilot's oxygen regulators.

Operation of the oxygen system is automatic when the cabin altitude exceeds 10,000 feet. However, to set up the system, the following procedures should be accomplished:

1. Oxygen system automatic manual override lever - CLOSED, and push reset button.

2. Passengers' oxygen toggle valve - ON if passengers are carried.

3. Oxygen regulator supply levers - Safetied ON.

4. Oxygen regulator diluter levers - NORMAL OXYGEN.

5. Oxygen regulator emergency levers - NORMAL.

OXYGEN WALK-AROUND BOTTLE.

An MA-1 oxygen walk-around bottle is mounted in the coat compartment or baggage compartment.† The bottle is complete with an A21 pressure-demand regulator, a gage, a hose, and a carrying strap attached to a covering around the bottle. The regulator knob positions are NORMAL (labeled "NORM"), 30,000 FEET (labeled "30M"), 42,000 FEET (labeled "42M"), and EMERGENCY (labeled "EMERG"). The knob should be left at NORMAL unless the cabin altitude increases to the 30,000 FEET or 42,000 FEET positions.

Caution If the knob is left at any position other than NORMAL when the bottle is not in use, the oxygen will escape.

The fully charged bottle (400 psi) has a duration dependent upon the cabin altitude and can range from 9 minutes at 10,000 feet to 58 minutes at 45,000 feet. (Because of lower atmospheric pressure at altitude, less oxygen is inhaled to fill the same lung volume, resulting in longer duration.) The crew's or passengers' oxygen masks can be used with the bottle.

When the pressure in the bottle has been depleted to approximately 50 psi, it should be recharged. This may be accomplished by using the oxygen recharge hose which is connected to the airplane oxygen system. On some airplanes,† the recharge hose is stowed beside the oxygen walk-around bottle in the coat compartment. On all other airplanes, the recharge hose is stowed in the copilot's mask storage box. The walk-around bottle can be recharged to a pressure equivalent to the crew's oxygen regulator pressure. To refill the walk-around bottle, proceed as follows:

NOTE Steps 1, 7, and 8 need be accomplished only on airplanes that have the recharge hose stowed in the coat compartment.

- Steps 7 and 8 are not to be accomplished if oxygen is required by the cabin occupants.

1. Automatic manual override lever—OPEN.

   When the automatic manual override lever valve is placed at OPEN (provided the passengers' oxygen toggle valve is ON), the passengers' oxygen flow indicator light, cabin signs, and cabin lights come on. In addition, the oxygen warning horn sounds and the passengers' oxygen compartment doors open.

2. Remove recharge hose from its stowed position.

3. Remove rubber cap from end of hose by rotating handle clockwise.

4. Place hose end-fitting onto nipple of walk-around bottle regulator, and snap into place.

5. Recharge walk-around bottle when its pressure is equalized with that of either the pilot's or the copilot's oxygen regulator pressure gage.

6. Uncouple hose from walk-around bottle, snap rubber cap in place, and stow.

7. Automatic manual override lever - CLOSED, and depress oxygen reset button.

8. Actuate ground test buttons or lever, return "in-use" valves to their clips, and close passengers' oxygen compartment doors.

COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT.

TABLE OF COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT.

See figure 4-9. See figure 4-10 for antenna locations.

RADIO AND INSTRUMENT MASTER SWITCH.

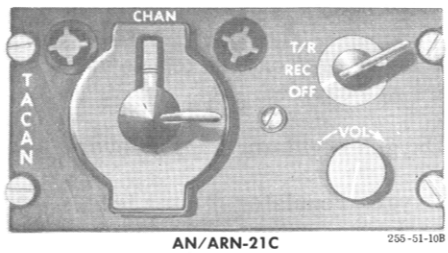
This positive-position switch (7, figure 1-6), on the overhead electrical master and emergency switch panel, is labeled "RADIO AND INSTRUMENT MASTER." The switch, which has two positions, is powered by the dc essential bus and controls electrical power to certain equipment which cannot be turned off individually. Its function is to turn off this equipment during extended ground maintenance and thereby prevent unneces-

† AF62-4491 and all later airplanes

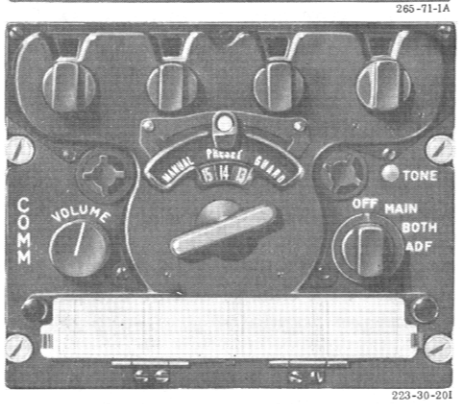
COMMUNICATION AND ASSOCIATED

265-71-1A

AN/AIC-10A
(TYPICAL – AIRPLANES NOT CHANGED BY T.O. 1T-39A-534, -544, OR -547)

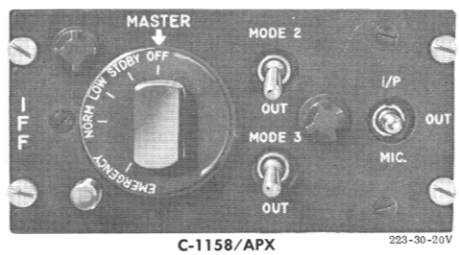


AN/ARN-21C
255-51-10B



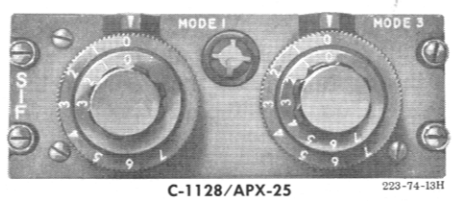
223-30-20I

AN/ARC-34A

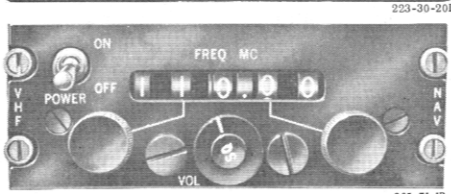


C-1158/APX
223-30-20V

AN/APX-46V



C-1128/APX-25
223-74-13H



265-71-1B

VOR NAVIGATION/INSTRUMENT LANDING SYSTEM

TYPE	DESIGNATION	FUNCTION	RANGE	LOCATION
INTERCOMMUNICATION SET	AN/AIC-10A	INTERSTATION COMMUNICATION AND RADIO SIGNAL AMPLIFICATION	NOT APPLICABLE	RIGHT AND LEFT CONSOLES IN COCKPIT. PASSENGER COMPARTMENT LEFT SIDE PANEL (GROUND CREW PANEL IN LEFT AFT FUSELAGE)
UHF COMMAND RADIO	AN/ARC-34A	TWO-WAY VOICE COMMUNICATION	LINE OF SIGHT	INSTRUMENT PANEL CENTER SECTION
TACAN	AN/ARN-21C	DISPLAYS AZIMUTH AND DISTANCE	LINE OF SIGHT UP TO 195 NAUTICAL MILES	INSTRUMENT PANEL CENTER SECTION
VOR †	51X-2B	RECEPTION OF OMNI AND LOCALIZER SIGNALS	LINE OF SIGHT	INSTRUMENT PANEL CENTER SECTION
GLIDE SLOPE RECEIVER †	51V-3 OR DGS-20	RECEPTION OF GLIDE SLOPE SIGNALS	30 MILES	
MARKER BEACON RECEIVER	51Z-2 OR 51Z-3	RECEIVES MARKER SIGNALS	NOT APPLICABLE	INSTRUMENT PANEL
IDENTIFICATION RADAR	APX-46V	AUTOMATIC TRANSMISSION OF IDENTIFICATION SIGNALS	LINE OF SIGHT	CENTER PEDESTAL

† These units comprise the VOR navigation/instrument landing system.

39A-1-71-1F

Figure 4-9

ELECTRONIC EQUIPMENT

276-51-1E

AIRPLANES CHANGED BY T.O. 1T-39A-534 OR -544

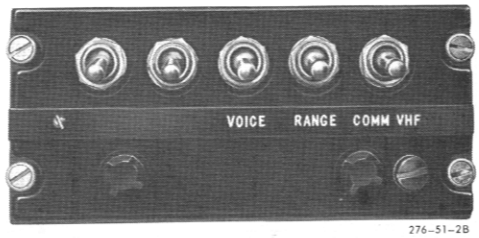
VHF-101

FS-591

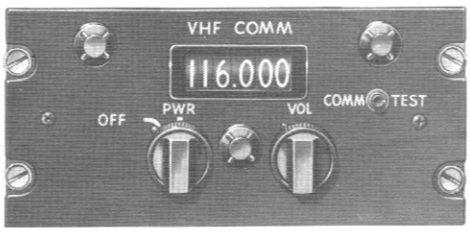
276-51-2A

AN/ARN-59

AN/AIC-10A



276-51-2B



FS1035

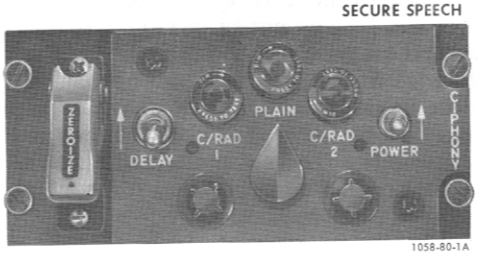
AIRPLANES CHANGED BY T.O. 1T-39A-547

WILCOX 807A

AN/AIC-10A

FS591A

SECURE SPEECH



1058-80-1A

AIRPLANES CHANGED BY T.O. 1T-39A-552 NEW

TYPE	DESIGNATION	FUNCTION	RANGE	LOCATION
INTERCOMMUNICATION SET	AN/AIC-10A	INTERSTATION COMMUNICATION AND RADIO SIGNAL AMPLIFICATION	NOT APPLICABLE	RIGHT AND LEFT CONSOLES; NAVIGATOR'S POSITION
VHF COMMAND RADIO	COLLINS VHF-101	TWO-WAY VOICE COMMUNICATION	LINE OF SIGHT	LEFT CONSOLE
AUTOMATIC DIRECTION FINDER	AN/ARN-59	RECEPTION OF VOICE AND CODE COMMUNICATION; POSITION FINDING; HOMING	TO 200 MILES	RIGHT CONSOLE
VHF COMMAND RADIO	WILCOX 807A	COMMUNICATION	LINE OF SIGHT	LEFT CONSOLE
SECURE SPEECH	———	PROVIDES CODING AND DECODING OF VOICE COMMUNICATION THROUGH UHF COMMAND RADIO	RADIO RANGE	RIGHT CONSOLE

39A-1-71-8D

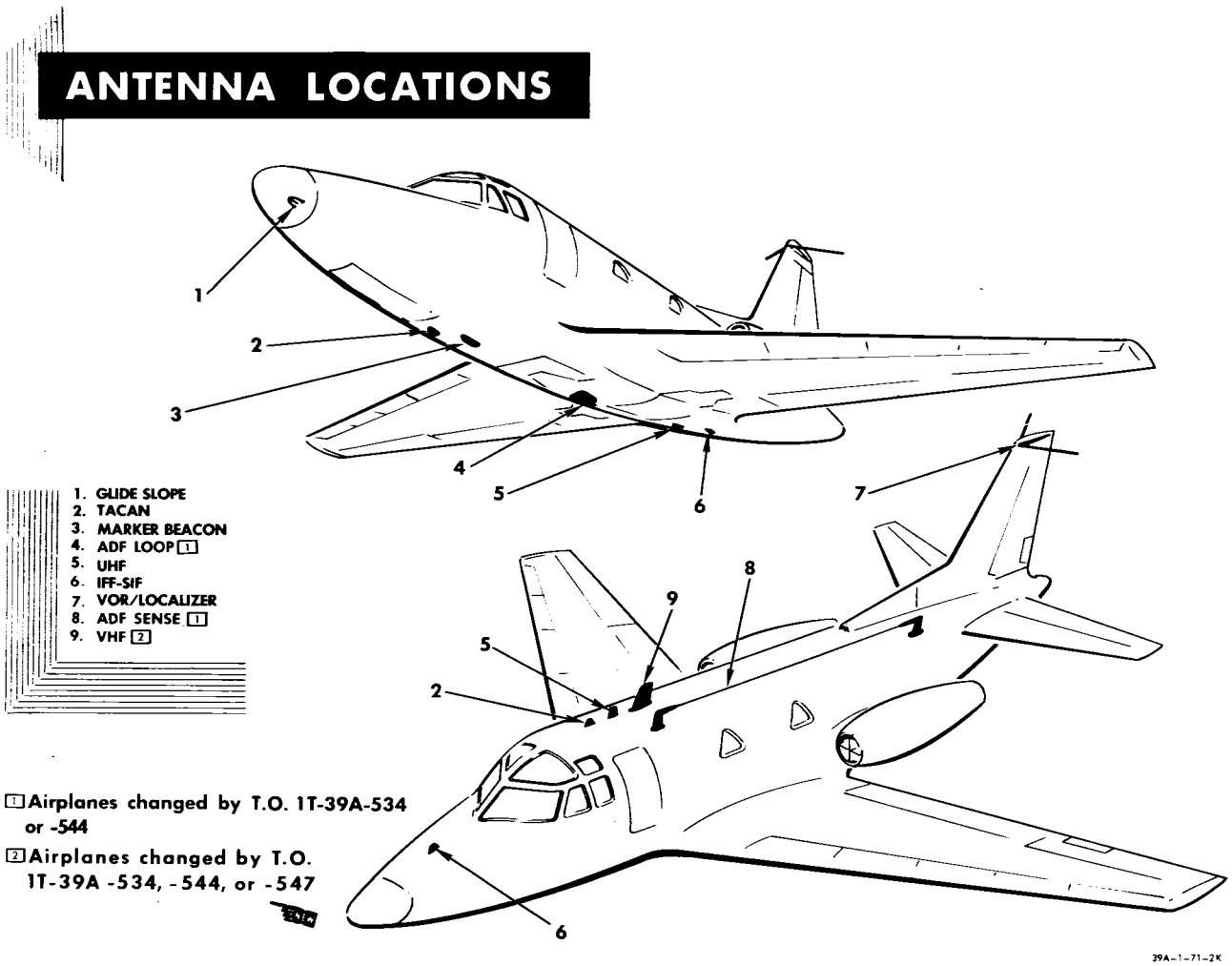


Figure 4-10

sary wear on the equipment. With electrical power on the airplane, placing the switch at OFF energizes five power control relays, cutting off power to the following equipment:

Copilot's turn-and-slip indicator

Electronic shelf and equipment blowers

Pilot's turn-and-slip indicator

Main and stand-by inverters

Marker beacon receiver

With electrical power on the airplane and the switch at ON, the five power control relays are de-energized, permitting power to be applied to the listed equipment.

INTERCOMMUNICATION SET - AN/AIC-10A.

This set is connected electrically to the command radio, TACAN receiver, VOR/localizer receiver, and the marker beacon receiver. On some airplanes, the intercommunication set is also connected electrically to the VHF command radio † and ADF receiver. ‡ The set is powered by the dc essential bus and amplifies radio signals sent and received. In addition, it provides interphone service between the various stations. It also provides interphone service between ground personnel and the airplane stations. The set includes an audio-frequency amplifier and control panel for each station, and three loud-speakers.

Audio-frequency Amplifiers and Speakers.

The station amplifiers are not accessible. The cockpit speakers are connected only to the pilot's amplifier output. The pilot's speaker is on the cockpit aft bulkhead, just to the left of the passageway. The copilot's speaker is behind and to the right of the copilot's seat. Both are remotely located from the pilot's station amplifier. The

† Airplanes changed by T.O. 1T-39A-534, -544, or -547

‡ Airplanes changed by T.O. 1T-39A-534 or -544

cabin amplifier and loud-speaker are within an integral housing, at the top center of the cabin aft bulkhead.

Cockpit Speaker Switch.

This two-position switch, on the interior lights and speaker control panel (3, figure 1-6), is labeled "SPKR." With the switch at ON, the cockpit loud-speakers are connected to the pilot's amplifier, and reception of all incoming signals, including signals from the cabin and ground stations, may be heard through the two cockpit speakers. Whenever the pilot or copilot keys a microphone, the cockpit speakers are disconnected to prevent feedback. With the switch at OFF, the cockpit speakers are disconnected during all intercommunication system functions except when the function selector switch at the cabin station or ground station is at CALL.

Cabin Speaker Switch.

This two-position switch (6, figure 4-12), labeled "SPKR," is just to the left of the navigator's intercommunication control panel. With the switch at ON, the cabin loudspeaker is connected to the cabin audio-frequency amplifier. With the switch at OFF, the cabin speaker is disconnected during all intercommunication functions except when the function selector switch at any station is at CALL.

NOTE If the cabin is not occupied, the cabin speaker switch may be turned OFF, to prevent feedback between the cabin speaker and the pilot's microphone.

Intercommunication Control Panels.

There are three intercommunication control panels for interstation use. One panel (11, figure 1-3), for the pilot, is on the left console. Another panel (9, figure 1-4), for the copilot, is on the right console. The third panel is on the left wall of the cabin between the seats or on the navigator's console.† The controls on each of these panels and their operation are identical, except that command radio transmission cannot be accomplished from the cabin station. On some airplanes, ‡ there are two additional intercommunication control panels. One panel (15, figure 1-3), for the pilot, is on the left console. Another panel (12, figure 1-4), for the copilot, is on the right console. Both panels are identical.

MIXER SWITCHES. Five switches control the mixed-signal facility of the intercommunication set. A mixer switch is ON when moved forward in relation to the control panel. When any switch or combination of switches is moved ON, the selected signals at that station can be monitored. When a switch is moved OFF (aft), the corresponding signal is cut out. Exceptions to this are when the function selector switch is at COMMAND, wherein command radio signals will still be received, regardless of the position of the "COMM" mixer switch; and when the function selector switch is at INTERPHONE, wherein interphone signals will be heard, regardless of the position of the "INPH" mixer switch. The switch marked "COMM" permits reception of command radio signals when the function selector switch is at INTERPHONE. The "MARKER" switch permits reception of marker beacon signals. The "VHF NAV" switch permits reception of VOR/localizer signals. The "TACAN" switch permits selection of TACAN signals. On some airplanes, § the "COMM," "MARKER," and "VHF NAV" switches have been replaced by switches labeled "UHF-COMM" switch permits reception of UHF command radio signals. The "COMM-VHF" switch permits reception of VHF command radio signals. The "MKR-NAV" switch permits reception of marker beacon and VOR/localizer signals. On other airplanes, ‡ there are three additional mixer switches on separate control panels at the pilot's and copilot's positions only. The switch marked "VOICE" provides monitoring facilities for ADF voice audio signals. The switch marked "RANGE" provides monitoring facilities for ADF range audio signals. The switch marked "COMM VHF" provides monitoring facilities for VHF command radio audio signals. To differentiate between the two command radios, the existing "COMM" switch is re-marked "COMM UHF."

On some airplanes, § the navigator's station intercommunication control panel is the same as that for the pilot and copilot. On other airplanes, ‡ the navigator's station intercommunication control panel is revised to place ADF receiver audio (voice and range) on the No. 2 switch position labeled "ADF." VHF command radio audio is monitored by the COMM VHF position on the function selector switch. By proper manipulation of the mixer switches and the function selector switch, the navigator can monitor all receivers and the interphone line.

FUNCTION SELECTOR SWITCH. This switch has three positions. The spring-loaded CALL position is used to call other occupants, regardless of the switch positions on their control panels. At the CALL position, the volume control is ineffective, and it is not necessary to press the microphone switch at the originating station. With the switch at INTERPHONE (labeled "INPH"), another station may be called only if that station's function selector switch is at INTERPHONE or the "INPH" mixer switch is at ON. The interphone-microphone switch must be at INTERPHONE

†AF60-3478 and all later airplanes
‡Airplanes changed by T.O. 1T-39A-534 or -544

§ Airplanes changed by T.O. 1T-39A-547

(cabin microphone button must be depressed) when speaking while using this function. With the switch at COMMAND (labeled "COMM"), command radio transmission at the pilot's and copilot's stations and reception at the cabin station can be accomplished, and any additional function selected by the mixer switches also will be received.

NOTE When the COMMAND position is selected at a particular station, command radio signals are heard, regardless of the position of the "COMM" mixer switch.

On airplanes with the VHF command radio, an additional switch position has been added at all three positions. This position, marked "COMM VHF," permits reception of VHF command radio signals, regardless of the position of the "COMM VHF" mixer switch. To differentiate between the two command radios, the existing COMM position is re-marked "COMM UHF."

"NORMAL - AUX LISTEN" SWITCH. This two-position switch should be safety-wired at NORMAL. It provides emergency listening in case of intercommunication amplifier failure. If the amplifier fails, indicated by the loss of interphone communications, break the safety wire and move the switch to AUXILIARY LISTEN (labeled "AUX LISTEN"). When the switch is in this position, the only signal heard is that of the farthest left mixer switch that is in the ON position. The mixer switches to the left of the selected mixer switch must be in the OFF position. If all the mixer switches are at the OFF position, the function selector switch becomes the primary control.

NOTE The volume control knob is not effective when this switch is at AUXILIARY LISTEN.

VOLUME CONTROL KNOB. Turning the volume control knob counterclockwise reduces the volume of the selected incoming radio signal. Turning it clockwise increases that signal. The knob should be set to a position to give the desired interphone communication volume before adjusting the volume of all receivers.

NOTE The CALL function overrides any setting of the volume control. Thus, CALL signals will always be heard in the headsets.

Ground Intercommunication Control Panel.

This control panel, for use by ground personnel, is behind an access door on the underside of the aft fuselage. The panel has a volume control knob, a "NORMAL - AUX LISTEN" switch, a call button, and a headset-microphone cable jack. The controls on this panel are functionally similar to those on the cockpit panels. The call button has a threaded cap-type cover which must be removed to gain access to the call button. Only interphone calls can be made from this station, and they will be received only if the airplane station being called is monitoring interphone calls.

Interphone-Microphone Switch and Microphone Button.

The pilot's and copilot's interphone-microphone switches are two-position, rocker-type switches and serve dual functions. The switches are on the forward side of the outboard handle of each control wheel. (See figure 1-20.) Depressing the switch to the MICROPHONE (labeled "MIC") position, with the associated function selector switch at COMMAND, initiates command radio transmission. Depressing the switch to the INTERPHONE (labeled "INTER") position initiates normal interphone operation only; however, the "INPH" mixer switch must be ON at all related stations in order to obtain interphone reception. Depressing the microphone button on the cabin station microphone permits interphone operation only from the cabin station to the other stations.

Operation of Intercommunication Set - AN/AIC-10A.

For selective interphone operation only:

1. Function selector switch - INTERPHONE.
2. "INPH" mixer switch - ON (all other mixer switches OFF).
3. Interphone-microphone switch - INTERPHONE (press cabin microphone button), and talk.

NOTE The switch (or button) must be released to allow the called station to reply.

For interphone call operation:

1. Function selector switch - Hold at CALL and talk.

NOTE All other stations will receive the message, regardless of the position of their function selector or mixer switches.

- Whenever the CALL position is used at the pilot or copilot station, it overrides the interphone-microphone switch. This prevents transmission of interphone conversation over the command radio.
- No signal mixing is possible during call operation.

To monitor other radio signals, at stations so equipped:

1. Loud-speaker switch - ON, if desired.
2. Function selector switch - INTERPHONE or COMMAND.
3. Desired mixer switches - ON.

NOTE This permits monitoring several different signals simultaneously.

4. Volume control knob - As desired.

For command radio transmission (pilot's or co-pilot's station):

1. Loud-speaker switch - ON, if desired.

2. Function selector switch - COMM UHF or COMM VHF. †

3. Interphone-microphone switch - MICROPHONE, and talk.

4. Interphone-microphone switch - Release when transmission is completed to permit receiving reply.

Emergency Operation of Intercommunication Set - AN/AIC-10A.

For reception of incoming radio transmission following interphone amplifier failure:

1. "NORMAL - AUX LISTEN" switch - AUXILIARY LISTEN.

2. Mixer switch for desired signal - ON (all other mixer switches OFF).

UHF COMMAND RADIO - AN/ARC-34A.

This radio, powered by the dc essential bus, provides voice transmission and reception in the frequency range of 225.0 to 399.9 megacycles. The audio signal is directed through the AN/AIC-10A communication amplifiers. A control panel in the cockpit permits selection of 20 preset channels, or operating frequencies can be selected manually without disturbing the preset channel frequencies. Two receivers are used in this equipment. The main receiver normally carries out all reception functions. The guard receiver is ground-tuned to a guard frequency, and may not be changed without removing the remote-control unit from the airplane. Whenever a new frequency is selected, an automatic tuning mechanism tunes the transmitter and receiver to the new frequency. This tuning cycle requires about 4 seconds.

Command Radio Controls.

All command radio controls are on the command radio control panel (figure 4-9), on the instrument panel center section, except the antenna selector switch which is on the pilot's inboard instrument panel.

CHANNEL SELECTOR SWITCH. The channel selector switch controls the selection of 20 preset frequencies by channel number. When the switch is rotated, channel numbers from 1 through 20 appear in the channel indicator window, above the selector. This window is masked when the sliding selector control is placed in any position other than PRESET.

FUNCTION SWITCH. Rotating the command radio function switch from OFF turns the command radio on. (A warm-up period of about one to two minutes is required.) When the switch is placed in the MAIN position, only the main receiver is audible in the headphones. In the BOTH position, the guard receiver and the main receiver are heard simultaneously. The ADF position is inoperative.

TONE BUTTON. When the command radio is turned on, a continuous tone signal is transmitted by pressing the tone button. This occurs on the frequency that is set on the transmitter, and it interrupts reception. A side tone is audible in the headphone while the button is depressed. This feature is useful in checking proper operation of the tuning mechanism during the preflight check, and for direction-finding operations in conjunction with other aircraft and ground stations.

VOLUME CONTROL KNOB. The volume control knob regulates the sound level of the signal being heard in the headphones from both command receivers. Adequate control of volume is provided, but the volume may not be reduced below a fixed level.

MANUAL-PRESET-GUARD SLIDING SELECTOR CONTROL. The sliding selector control controls the method of command radio frequency selection. It is operated by sliding the control through a limited arc across the face of the panel. This control has three positions, MANUAL, PRESET, and GUARD, and is arranged so that when it is in any one position, the other two positions are masked by a semitransparent green glass.

In the MANUAL position, four windows across the top of the panel reveal the numerals that make up an operating frequency. Beneath each window is a small knob which, when rotated, changes the numeral and the frequency. This makes it possible to manually select 1750 frequencies within the range of 225.0 through 399.9 megacycles. The frequency range of 329.0 through 335.0 megacycles is reserved for glide slope frequencies, and 243.0 megacycles is reserved for a guard frequency. While the sliding selector control is in the MANUAL position, the preset channels may be changed or checked without affecting the operation of the manually selected frequency.

Sliding the control to PRESET deactivates the manually selected frequency and activates the 20 preset channels controlled by the channel selector switch. Any time a frequency is changed, about

† Airplanes changed by T.O. 1T-39A-534, -544, or -547

4 seconds is required for the tuning mechanism to complete the cycle.

Caution Do not depress interphone-microphone switch during frequency change, as damage to equipment may result.

Placing the sliding selector control in the GUARD position automatically tunes the transmitter and main receiver to the guard frequency set up before the installation of the equipment.

ANTENNA SELECTOR SWITCH. A three-position command radio antenna selector switch (18, figure 1-2) permits manual or automatic selection of either the upper antenna or the lower antenna. Power to the switch is from the dc essential bus. When the switch is at UPPER or LOWER, transmission and reception is through the selected antenna. Transmission and reception is through the antenna receiving the stronger signal when the switch is at AUTOMATIC (labeled "AUTO").

Normal Operation of Command Radio.

1. Function switch - BOTH.
2. Initial channel selection - Complete.

   The interphone-microphone switch should not be used while the frequency is being changed. Allow about 4 seconds for the set to tune itself before transmitting.

3. Antenna selector switch - AUTOMATIC.
4. Sliding selector control - MANUAL, if required.

   For manual selection of a frequency that is not included in the preset channels, move sliding selector control to MANUAL. Use the four knobs across top of panel to establish desired frequency. The numerals that appear in the windows indicate the operating frequency. (The function switch must be at MAIN or BOTH for this operation.)

NOTE Do not select a frequency of less than 225.0 megacycles. An indication of this error will be continuous recycling of the receiver-transmitter. If this should happen, turn the function switch to the OFF position. Recheck the preset or manually set frequency being used. Set the channel to the proper frequency; then turn the equipment on.

5. Sliding selector control - GUARD, if required.

   To obtain transmission and reception of guard frequency only, move sliding selector control to GUARD.

6. Function switch - OFF.

Emergency Operation of Command Radio.

SUDDEN LOSS OF TRANSMISSION AND RECEPTION. If the command radio will not transmit or receive satisfactorily within the range of the equipment, the automatic antenna switching system may have malfunctioned. In this event, attempt to establish communication by moving the antenna selector switch first to LOWER, then to UPPER. If communication cannot be established, move the switch to AUTOMATIC and follow the instructions given under "Radio Not Operating" in this section.

RADIO NOT OPERATING. In the case of apparent failure of command radio, attempt operation in alternate positions of sliding selector control and/or alternate positions of function switch. Turn equipment off for several minutes; then turn function switch to type of operation desired. If the protective relay in the tuning mechanism was responsible, this action will restore operation. Check circuit-breaker panel for tripped condition of the AN/AIC-10A amplifier.

SECURE SPEECH SYSTEM - AIRPLANES CHANGED BY T.O. 1T-39A-552.

The secure speech system permits either normal operation of the UHF command radio or decoding and coding of voice communications through the UHF command radio. The decoding and coding capability prevents interception of messages when required. The system is powered by the dc essential bus.

Power Switch.

When the power switch (figure 4-9) is moved forward (ON), power is applied to the secure speech system. The UHF command radio can be operated in the normal manner with the power switch aft (OFF).

Function Switch.

With power applied to the system, the function switch (figure 4-9) controls decoding and coding of UHF command radio voice reception and transmission.

NOTE With the switch at PLAIN, normal operation of the command radio is available, and only uncoded reception and transmission is possible.

With the switch at C/RAD 2, the system decodes incoming voice communications, and codes outgoing voice communications through the UHF command radio. The C/RAD 1 position has no function in these airplanes.

Function Indicator Lights.

Three dimmable, press-to-test type lights (figure 4-9) indicate the position selected by the function switch. With power applied to the system, the right (green) light comes on when the C/RAD 2 position of the function switch is selected; the middle (amber) light comes on when the PLAIN position of the function switch is selected; the left (green) light is inoperative on these airplanes.

Zeroize Switch.

The zeroize switch (figure 4-9) is guarded in the normal, aft (OFF) position. If it becomes necessary to bail out, the guard should be raised and the switch held momentarily at the forward (ON) position. This zeros out the ground set codes in the secure speech system.

Delay Switch.

This switch (figure 4-9) has no function in these airplanes. The switch should always be aft (OFF), regardless of the position of the function switch.

Operation of Secure Speech System.

1. Turn on UHF command radio. (Refer to "Normal Operation of Command Radio.")

2. Place antenna selector switch in desired position.

NOTE When the antenna selector switch is in AUTO and the secure speech function switch is at C/RAD 2, transmission and reception are through the upper antenna only.

3. Move power switch forward (ON).

4. Turn function switch to PLAIN and establish communications through normal transmission procedures where possible.

5. Turn function switch to C/RAD 2 and listen for a steady unbroken tone in the headphones for approximately 2 seconds, followed by a double-pitched broken tone. If a prolonged steady tone is heard, it indicates an improper code setting or equipment malfunction, and the function switch should be turned to PLAIN and the power switch should be moved aft (OFF).

6. Press and hold microphone switch for several seconds; then release. The double-pitched broken tone should stop, and no further sound will be heard in the headphones. If the broken tone continues, press microphone switch again and hold for several seconds. If the broken tone continues after three such attempts to clear it, move function switch to PLAIN and power switch aft (OFF).

7. Press and hold microphone switch. Wait 1/2 to 2 seconds for a single beep tone in the headphones. If beep tone is not heard, press microphone switch again and wait 1/2 to 2 seconds. If beep tone still is not heard, move power switch aft (OFF) and then forward (ON) and repeat steps 6 and 7. If this fails to produce the beep tone, turn function switch to PLAIN and position power switch aft (OFF).

8. When beep tone is heard, begin transmission.

IDENTIFICATION RADAR - AN/APX-46V..

The AN/APX-46V identification radar set provides selective identification of the airplane in response to IFF interrogations. The set includes an RT-556 receiver-transmitter, a C-1158/APX IFF control panel, a C-1128/APX-25 SIF coder-decoder control panel, and an antenna switching unit.

The antenna switching unit ensures optimum reception of interrogation signals and transmission of replies. The switching unit continuously transfers the receiver-transmitter to and from the upper and lower antennas. Replies to an interrogation will also be transmitted over the same antenna receiving the interrogation. The set receives power from the 28-volt dc essential bus and the 115-volt, A-phase, ac nonessential bus.

Identification Radar Controls.

The AN/APX-46V identification radar controls are on two panels. The IFF control panel (figure 4-9), on the center pedestal, includes a master switch, mode 2 and mode 3 switches, and an I/P reply switch. The master switch has five positions - OFF, STANDBY (labeled "STDBY"), LOW, NORMAL (labeled "NORM."), and EMERGENCY - and is powered by the dc essential bus. Selection of the STANDBY position will warm up the set; however, challenges are not received. When NORMAL is selected, the set operates throughout its maximum range. With the switch at LOW, sensitivity is reduced. When the switch is at either NORMAL or LOW, the set responds only to challenges correctly coded for the mode of operation selected. With the switch at EMERGENCY, the coded reply will be automatically transmitted four times in response to each interrogation pulse.

NOTE To move the master switch to EMERGENCY, an interlock button just to the bottom left of the switch must be depressed and held while the switch is being moved.

The mode 2 switch has two positions, MODE 2 and OUT. The mode 3 switch has two positions, MODE 3 and OUT. The I/P reply switch has three positions: a maintained MIC position, a maintained OUT position, and a momentary I/P position.

The position of mode 2 and mode 3 switches determines whether or not the equipment will reply to interrogations in mode 2 or mode 3. The equipment always replies to interrogation in mode 1. When the mode 2 switch is at MODE 2, the equipment will reply to interrogation in both modes 1 and 2. When the mode 3 switch is at MODE 3, the equipment will reply to interrogations in modes 1 and 3. When the respective switches are at MODE 2 and MODE 3, the equipment will reply to interrogation in modes 1, 2, and 3. When the I/P reply switch is momentarily placed in the I/P position, the equipment will reply to all mode 1 interrogations and to mode 2 and mode 3 interrogations, provided the mode switches are in the MODE 2 and MODE 3 positions.

The SIF control panel has two sets of concentric rotary code switches labeled "MODE 1" and "MODE 3." The mode 1 inner switch has positions 0 through 3, and the outer switch has positions 0 through 7. The mode 3 inner and outer switches have positions 0 through 7. The positions selected on each set of switches determine the specific selective identification reply sent. Mode 2 reply codes are preset before flight.

Operation of Identification Radar.

1. IFF master switch - STANDBY.

   The master switch must be at STANDBY for a 3-minute warm-up period.

2. IFF I/P reply switch - OUT.

3. IFF mode 2 and mode 3 switches - As required.

   Position IFF mode 2 and mode 3 switches for desired operation as follows:

MODE NO. OF OPERATION	MODE SWITCH POSITION
1	OUT (all switches)
1 and 2	Mode 2 switch at MODE 2 (mode 3 and I/P reply switches at OUT)
1 and 3	Mode 3 switch at MODE 3 (mode 2 and I/P reply switch at OUT)
1, 2, and 3	Mode 2 switch at MODE 2 and mode 3 switch at MODE 3 (I/P reply switch at OUT)

4. SIF code switches - As required.

5. IFF master switch - LOW or NORMAL.

6. IFF I/P reply switch - I/P momentarily, then release to OUT.

NOTE If in distress, press IFF interlock button and rotate master switch to EMERGENCY. An emergency reply will be transmitted in response to a mode 1 or mode 3 interrogation.

7. IFF master switch - OFF.

   To turn identification radar set off, rotate IFF master switch to OFF.

VHF COMMAND RADIO - VHF-807A - AIRPLANES CHANGED BY T.O. 1T-39A-547.

The Wilcox 807A VHF command radio is used for short-range, line-of-sight, two-way radio voice communication. The transceiver, in the forward baggage area, transmits and receives in the frequency range of 116.000 to 149.975 megacycles. The transceiver control panel is on the pilot's console. The blade-type antenna is installed on the upper fuselage. (See figure 4-10.) The audio signal of the transceiver is directed through the intercommunication system. The intercom control panel is provided with a "COMM VHF" position on the function selector switch dial, and a change is made to the mixer strip at all stations to permit selection of system signals. System power is received from the dc essential bus. A circuit breaker, labeled "VHF COMM," is on the aft end of the left console circuit-breaker panel.

Command Radio Controls.

All Wilcox 807A VHF command radio controls are on the 807A communication control panel on the pilot's console. (See figure 4-9.)

POWER SWITCH. The rotary-type on-off power switch is a knurled ring encircling the left frequency selector knob. It has labeled positions OFF and PWR. To turn the set on, the switch is moved

to PWR. A warm-up period of about 2 minutes is required.

VOLUME CONTROL. The rotary-type volume control is a knurled ring encircling the right-hand frequency selector knob. It is labeled "VOL." Clockwise rotation of the control increases volume.

FREQUENCY SELECTOR KNOBS. There are two frequency selector knobs. The desired frequency in megacycles (increments of 25 kilocycles) is obtained by turning the right knob. The selected frequency appears in the six-counter indicator just above the frequency knobs. The left three counters indicate the frequency in megacycles, and the right three counters indicate the frequency in kilocycles.

COMMUNICATION TEST BUTTON. The communication test button, just to the right of the frequency indicator, provides a means of checking receiver operation. In case of weak or no signal, pressing the button disables the receiver squelch action, resulting in higher background noise.

Operation of VHF Command Radio.

1. Place intercommunication set function selector switch at COMM VHF.

2. Rotate power switch to PWR.

   Allow about 2 minutes for warm-up after the power switch has been turned on.

3. Turn frequency selector knobs to desired frequency.

4. Adjust volume control as desired.

5. Press microphone switch on either control wheel to transmit.

6. To test receiver operation, press communication test button momentarily.

7. To monitor, set "COMM-VHF" mixer switch to desired position.

VHF COMMAND RADIO - VHF-101 - AIRPLANES CHANGED BY T. O. 1T-39A-534 OR -544.

The Collins VHF-101 communication system is used for short-range, line-of-sight, two-way radio voice communication. The system includes a 17L-7A VHF communication transmitter and a 51X-2B VHF communication receiver. The units are controlled by a 614U-6 VHF communication control panel. The transmitter transmits in the frequency range of 116.00 to 149.95 megacycles in increments of 50 kilocycles. There are 680 crystal-controlled channels available for selection by the control unit. The receiver operates in the frequency range of 116.00 to 151.95 megacycles with 880 crystal-controlled channels available. The audio signal is directed through the intercommunication system. System power is received from the dc essential bus.

Command Radio Controls.

All VHF-101 command radio controls are on the VHF-101 communication control panel on the pilot's console. (See figure 4-9.)

POWER SWITCH. This two-position switch controls power to the system.

FREQUENCY SELECTOR KNOBS. The two frequency selector knobs are used to select the desired frequency. The selected frequencies appear as a direct-reading number (in megacycles) in the frequency indicator window. The right knob sets the two right counter drums in the frequency window. The left knob sets the three left counter drums.

NOTE Setting frequencies to the nearest 0.05 mc will provide satisfactory reception.

VOLUME CONTROL KNOBS. The volume control knob ("VOL") adjusts the receiver volume level in the interphone system. Volume is increased when the knob is turned clockwise.

SQUELCH CONTROL KNOB. The squelch knob ("SQ") adjusts the squelch threshold of the receiver output. To pick up a weak signal, the squelch control knob should be turned clockwise. When excessive background noise is encountered, the control should be turned counterclockwise until the background noise is at a minimum.

SCS-DCS/DCD SWITCH. Either position of this two-position switch places the system in single-channel-simplex (SCS). Single-channel-simplex means the receiver and transmitter are tuned to the same frequency with a common control and utilize a common antenna. The receiver is disabled during operation of the transmitter. Operation is thereby restricted to either transmission or reception on the assigned channel.

AUTOMATIC DIRECTION FINDER SYSTEM - AN / ARN-59 - AIRPLANES CHANGED BY T. O. 1T-39A-534 OR -544.

The AN/ARN-59 automatic direction finder system provides navigation bearings on any continuous radio signal between 190 and 1750 kilocycles. The system includes an R-836/ARN ADF radio receiver and a Type C-2275/ARN receiver control panel. ADF bearing information is presented on the HSI and the No. 1 pointer of the copilot's and navigator's BDHI. System power is received from the dc essential bus and the 26-volt, No. 2 ac bus. Audio

indication in all methods of operation are received through the intercommunication system.

ADF Radio Controls.

All ADF radio controls are on the ADF receiver control panel (figure 4-9) on the copilot's console. Two-position switches are provided on the pilot's and copilot's instrument panels to place ADF bearing information on their respective instruments.

BAND SWITCH. The band switch ("MC BAND") selects the frequency band in which the equipment will operate. The three positions are 0.19 to 0.40 mc, 0.40 to 0.84 mc, and 0.84 to 1.75 mc.

FREQUENCY DIAL. The frequency dial displays the frequency band selected by the "MC BAND" switch and shows the frequency of the selected station against a hairline.

VOLUME CONTROL. The volume control ("VOL") regulates audio gain in compass operation and controls RF sensitivity in loop operation and low-frequency radio reception. It also serves to supply power to the set.

FUNCTION SWITCH. The function selector switch is a three-position rotary switch, marked "COMP-ANT-LOOP." With the switch in the COMP position, the sense and the loop antennas are connected in the system. The set functions as an automatic direction finder. With the switch in the LOOP position, only the loop antenna is used. The set functions as a manual direction finder by use of the "LOOP" switch. In the ANT position, only the sense antenna is used. The set functions as a low-frequency receiver.

TUNING METER. The tuning meter provides an indication of exact station tuning with a peak reading.

TUNING CRANK. The tuning crank is used to tune the receiver to the desired frequency.

BEAT FREQUENCY OSCILLATOR SWITCH. The beat frequency oscillator switch ("BFO") controls operation (off-on) of the beat frequency oscillator in the receiver. The beat frequency oscillator creates an audio note on unmodulated or on keyed continuous-wave stations.

NO. 1 Pointer Switch.

This two-position switch (figure 1-2), on the copilot's outboard instrument panel, is used to select the type of bearing information to be supplied to the No. 1 pointer of the copilot's BDHI and the navigator's BDHI. With the switch at TACAN BRG, the No. 1 pointer will indicate the magnetic bearing to the TACAN station selected. With the switch at ADF BRG, the pointer will indicate the magnetic bearing to station.

HSI Bearing Selector Switch.

This two-position switch (figure 1-2), on the pilot's outboard instrument panel, controls bearing information input to the bearing pointer of the HSI. With the switch at NORMAL, the bearing pointer functions normally. [Refer to "Horizontal Situation Indicator (HSI)."] With the switch in ADF BRG, ADF bearing information is supplied to the bearing pointer. The course deviation indicator does not function with ADF operation, but may show TACAN, VOR, or ILS while in the ADF mode.

LIGHTING EQUIPMENT.

EXTERIOR LIGHTING.

Exterior lighting consists of a position light on each wing tip, two position lights faired into the tail cone, a red anticollision light on the vertical stabilizer and one on the bottom of the fuselage just forward of the speed brake, and an ice-check light on each side of the fuselage, aimed at the wing leading edge. Two two-position landing-taxi lights are in the lower nose section behind a window. The position and landing-taxi lights are powered by the dc essential bus. The anticollision and ice-check lights are powered by the No. 1 dc secondary bus. The lighting circuits are protected by circuit breakers (figure 1-17) on the overhead circuit-breaker panels.

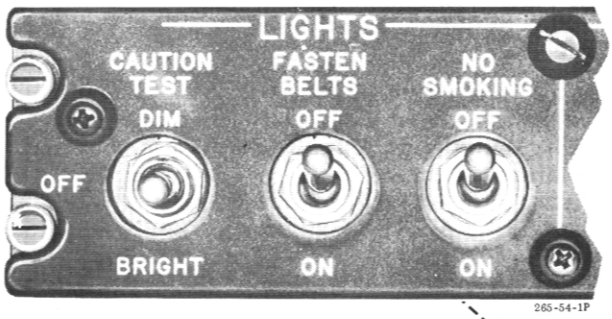
Position Light Switch.

The position light switch (figure 4-11) is on the exterior lighting control panel on the pilot's instrument subpanel. This two-position switch is powered by the dc essential bus and controls the red and green lights on the wing tips and the two white taillights. Moving the switch to ON turns on the position lights, and the OFF position turns the lights off. There is no flasher position.

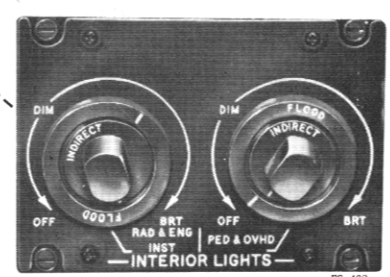
Anticollision Light Switch.

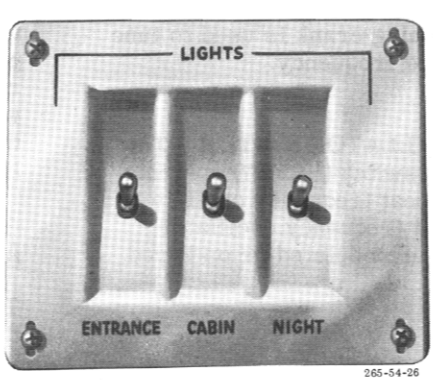
The anticollision light switch (figure 4-11) is on the exterior light control panel on the pilot's instrument subpanel. This two-position switch is powered by the No. 1 dc secondary bus. Moving the switch to ON supplies power to the rotating mechanism and to the red lights of the unit on the top of the vertical stabilizer and under the fuselage

LIGHTING CONTROL PANELS



TYPICAL BOTH SIDES





MAIN ENTRANCE LIGHT SWITCHES (TO LEFT OF DOOR)

T-39A-1-54-4C

Figure 4-11

just forward of the speed brake. These lights rotate within a streamlined enclosure to provide a flashing-type red warning light that can be seen at great distances. When the switch is moved to OFF, power to the motor and both bulbs is shut off.

Landing-Taxi Light Switch.

The three-position landing-taxi light switch (figure 4-11) is on the aft face of the center pedestal. The switch is powered by the dc essential bus and has the following positions: BOTH, OFF, and LEFTHAND ONLY (labeled "LH ONLY"). Moving the switch to BOTH turns on both landing-taxi lights. After the nose gear touches down, a rotary solenoid repositions the lights to a taxi position. (The light beam is directed farther ahead of the airplane.) Moving the switch to OFF turns off the landing-taxi lights. Moving the landing-taxi light switch to LEFTHAND ONLY turns on the left-hand landing-taxi light.

Caution To prevent damage to the plastic light cover, do not leave the lights on longer than 2 minutes during static ground testing. During taxiing, use LEFTHAND ONLY position.

Ice-check Light Switch.

The two-position ice-check light switch (figure 4-11), on the exterior lighting control panel on the pilot's instrument subpanel, is powered by the NO. 1 dc secondary bus. Moving the switch to ON lights the dual-bulb ice-check lights on each side of the fuselage. These lights shine on the wing leading edges to show if there is any wing icing. Moving the switch to OFF turns off these lights.

INTERIOR LIGHTING.

In the cockpit, all the instruments and the stand-by compass are integrally lighted. The position markings and names of the controls and switches on the various control panels are illuminated indirectly by edge lighting. The navigator's instruments† do not have integral lighting. A map and utility light and two sockets are provided above both the pilot's and copilot's consoles. Direct lighting of the consoles, instrument panel, and center pedestal is provided by 17 floodlights. Two thunderstorm lights and a dome light are also provided in the pilot's compartment. In the cabin, illumination is provided by three dome lights, two main entrance overhead door lights, a floor step light, a baggage compartment light, and a coat compartment light or crew-chief/passenger seat light.† By each of the four passenger seats, and on some airplanes† above each side of the two-passenger/baggage seat, is a reading light. (On some airplanes,† a light is provided above the navigator's console for illumination of the navigator's console and chart board.) Two lights are provided for the interior of the aft fuselage (not accessible during flight). An emergency light system is provided in case of complete electrical failure.

† AF60-3478 and all later airplanes
† Airplanes changed by T.O. 1T-39A-549

Console Light Rheostats.

Lighting of the pilot's or copilot's console is controlled by a dual rheostat (figure 4-11) on the interior light control panel on each console. Each rheostat, marked "CONSOLE LIGHTS," controls the indirect lights and floodlights for its respective console from OFF to BRIGHT. The center oblong knob, marked "INDIRECT," controls power from the 5-volt ac indirect light bus for edge lighting of the console and instrument subpanels. The outer ring, marked "FLOOD," of the pilot's rheostat controls power from the No. 1 dc secondary bus for the floodlights of the pilot's console. The outer ring of the copilot's rheostat controls power from the No. 2 dc secondary bus for the floodlights of the copilot's console.

Flight Instrument Light Rheostat.

Lighting of the pilot's side and the copilot's side of the instrument panel is controlled by its respective dual rheostat (figure 4-11) on the interior light control panel on each console. Each rheostat, marked "FLIGHT INSTRUMENT LIGHTS," controls the integral instrument lights, and the instrument panel floodlights for its respective group of flight instruments from OFF to BRIGHT. The center oblong knob, marked "INDIRECT," of each panel controls power from the 5-volt ac indirect light bus for the integral lighting of the flight instruments. The pilot's knob supplies power to the red light over the in-flight escape hatch and dims the caution and warning lights. The outer ring, marked "FLOOD," of the copilot's rheostat controls power from the No. 2 dc secondary bus for the floodlights for the copilot's side of the instrument panel. The outer ring of the pilot's rheostat controls power from the dc essential bus for the floodlights of the pilot's group of flight instruments.

Radio and Engine Instrument Light Rheostat.

Lighting of the radio control panels, engine instruments, and miscellaneous instruments is controlled by a dual rheostat (figure 4-11) on the interior light control panel on the aft face of the center pedestal. This rheostat, marked "RAD & ENG INST," controls the integral instrument lights, edge-lighted radio control panels, and floodlights from OFF to BRIGHT (labeled "BRT") for the center of the instrument panel. The center oblong knob, marked "INDIRECT," controls power from the 5-volt ac indirect light bus for integral

and edge lighting. The outer ring, marked "FLOOD," controls dc essential bus power for the center instrument panel floodlights.

Pedestal and Overhead Light Rheostat.

Lighting of the panels on the center pedestal and overhead is controlled by a dual rheostat (figure 4-11) on the interior light control panel on the aft face of the center pedestal. This rheostat, marked "PED & OVHD," controls the edge lighting and floodlighting of these panels from OFF to BRIGHT (labeled "BRT"). The center oblong knob, marked "INDIRECT," controls power from the 5-volt ac indirect light bus for the edge lighting of the panels and integral lighting of the stand-by compass. The outer ring, marked "FLOOD," controls dc essential bus power for the center pedestal floodlights.

Thunderstorm Light Switch.

The three-position thunderstorm light switch (figure 4-11), on the lighting overhead control panel, is powered by the No. 1 dc secondary bus. The switch has DIM, OFF, and BRIGHT positions and controls the two white thunderstorm lights in the cockpit (pilot's compartment). The DIM or BRIGHT positions, selected with the switch, are used to obtain the desired brightness. The OFF position turns off the lights.

Cockpit Dome Light Switch.

The three-position cockpit dome light switch (figure 4-11), on the lighting overhead control panel, is powered by the No. 1 dc secondary bus. The switch has WHITE, OFF, and RED positions. Moving the switch to WHITE or RED illuminates the respective bulb in the dome light. The single OFF position turns off both bulbs.

Caution Light Test Switch.

Refer to "Caution Light Test Switch" in Section I.

Fasten Seat Belts Cabin Sign Switch.

The two-position fasten seat belts cabin sign switch (figure 4-11) is overhead on the lights-speaker control panel. The switch has an ON and OFF position and is powered by the dc essential bus. Moving the switch to ON turns on the "FASTEN SEAT BELTS" signs in the cabin. The OFF position turns the signs off.

No Smoking Cabin Sign Switch.

The two-position no smoking cabin sign switch (figure 4-11) is overhead on the lights-speaker control panel. The switch has an ON and OFF position and is powered by the dc essential bus. Moving the switch to ON turns on the "NO SMOKING" signs in the cabin. The OFF position turns the signs off.

Cabin Light Color-control Switch.

The color, red or white, of the cabin dome lights is controlled by the two-position cabin light color-control switch (figure 4-11) on the interior lighting overhead control panel in the cockpit. The switch has NORMAL and RED positions and is powered by the dc essential bus. With the switch at NORMAL, the cabin light switch will light the white cabin dome lights. Moving the cabin light color-control switch to RED turns on the red dome lights in the cabin and turns off the entrance lights and passengers' reading lights. The three switches by the entrance door and the passengers' reading light switches are inoperative when the cabin light color-control switch is at RED.

Cabin Passenger Light Switch.

The dome lights for the cabin are controlled by the two-position cabin light switch (figure 4-11), on the aft side of the cockpit bulkhead by the main entrance door. The switch has an on and off position and is powered by the dc essential bus. Moving the switch up (toward "LIGHTS"), when the cabin light color-control switch is at NORMAL, turns on the white dome lights in the cabin. Moving the switch down (toward "CABIN") turns off the lights.

Night Light Switch.

The two-position cabin night light switch (figure 4-11), on the aft side of the cockpit bulkhead by the main entrance door, is powered by the dc essential bus. Moving the switch up (toward "LIGHTS") turns on the cabin red lights, if the cabin light switch is down (toward "CABIN") and the cabin light color-control switch is at NORMAL. Moving the switch down (toward "NIGHT") turns the night lights off. If the cabin light switch is up, the night light switch is inoperative.

Entrance Light Switch.

The two-position entrance light switch (figure 4-11), on the aft side of the cockpit bulkhead by the main entrance door, is powered by the No. 1 dc secondary bus and controls the two overhead entrance door lights. Moving the switch up (toward "LIGHTS") will turn on the main entrance lights, provided the cabin light color-control switch is at NORMAL. Moving the switch down (toward "ENTRANCE") shuts off the entrance lights.

Baggage Compartment Light and Switch.

The baggage compartment light and switch unit is in the ceiling over the baggage compartment in the cabin area. The two-position switch is powered by the dc essential bus. Moving the switch to ON turns on the light, and moving the switch to OFF turns it off.

Coat Compartment Light and Switch.†

The coat compartment light and switch unit is in the ceiling over the coat compartment in the cabin area. The two-position switch is powered by the dc essential bus. Moving the switch to ON turns on the light, and moving the switch to OFF turns if off.

Crew-Chief/Passenger Light and Switch.†

The crew-chief/passenger light and switch unit is in the ceiling over the crew-chief/passenger seat. The two-position switch is powered by the dc essential bus. Moving the switch to ON turns on the light, and moving the switch to OFF turns it off.

Passenger's Reading Lights and Switches.

An adjustable eyeball-type white reading light and push-button switch is above each passenger seat, except the crew-chief/passenger seat, next to the cold-air outlet. The switch is powered by the No. 2 dc secondary bus. Pushing the single button between the light and the cold-air outlet turns the light on or off if the cabin light color-control switch is at NORMAL.

Emergency Lighting.

Refer to "Emergency Lighting" in Section I.

Main Entrance Door-open Caution Light.

Refer to "Door-open Caution Light" in Section I.

Map and Utility Light Controls.

A portable map and utility light (2, figure 1-3; and 6, figure 1-4) is provided for the pilot and copilot above each console. These lights may be adjusted in color from white to red, in light pattern from spot to flood, and in brilliancy from off to bright. On an adjustable collar at the forward end of the light barrel are a series of dots coded as follows:

Large white - white flood
Small white - white spot
Small red - red spot
Large red - red flood

Light pattern and color is obtained by rotating the collar to align the dot (corresponding to the light pattern and color desired) with a white index marker on the forward end of the light barrel. A red rheostat knob at the aft end of the light is marked "OFF," "DIM," and "BRIGHT." When one of these labeled positions is aligned with a white index marker at the aft end of the barrel, corresponding brilliance is obtained. Depressing a push-button switch on the aft face of the rheostat knob provides momentary full brilliance, regardless of the rheostat setting. The pilot's utility light is powered by the dc essential bus, and the copilot's utility light is powered by the No. 2 dc secondary bus.

NAVIGATION EQUIPMENT.§

NAVIGATOR'S STATION.

The left rear seat in the cabin can be used as a navigator's station. On the side panel forward of the navigator's seat is a console (figure 4-12) containing the navigator's instruments and intercommunication control panel. A chartboard can be attached to the console, and a light is provided above the console for illumination of the console and chartboard. A mount for the navigator's sextant also is provided.

Altimeter.†

An MA-1 altimeter (2, figure 4-12) is on the navigator's console. The altimeter is identical to the pilot's and copilot's altimeters. (Refer to "Altimeter" in Section I.) The navigator's altimeter uses the same static-pressure sources as the copilot's altimeter.

True Airspeed Indicator.

An M-5 true airspeed indicator (4, figure 4-12) is on the navigator's console. The instrument dial has a range of 150 to 600 knots TAS and is calibrated in increments of 10 knots. The instrument senses static and pitot pressures and free air temperature, and interprets these inputs as true airspeed. The system is designed to indicate true airspeed through the altitude range of 1000 feet below sea level to 50,000 feet above sea level and under free air temperature conditions from -60°C to 40°C.

Free Air Temperature Indicator.

A free temperature indicator (5, figure 4-12) is on the navigator's console. The indicator and its operation are identical to the free air temperature indicator on the copilot's outboard instrument panel. A ram-air recovery coefficient of 0.62 should be used for free air computations. (Refer to "Free Air Temperature Indicator" in Section I.)

† Airplanes not changed by T.O. 1T-39A-549
‡ Airplanes changed by T.O. 1T-39A-549
§ AF60-3478 and all later airplanes

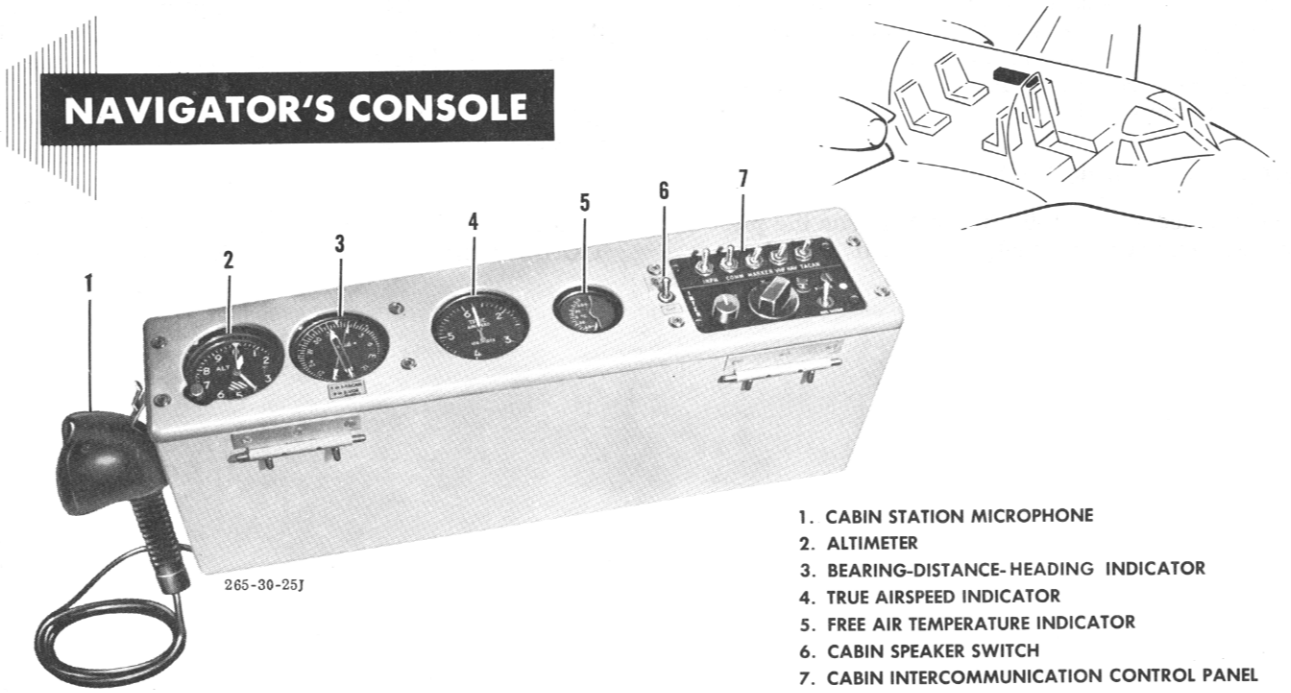


Figure 4-12

Bearing-Distance-Heading Indicator (BDHI).

The rearing-distance-heading indicator (3, figure 4-12), on the navigator's console, is identical to the copilot's BDHI, and its operation is the same. Refer to "Bearing-Distance-Heading Indicator (BHDI)" under "Flight Director System" in this section.

Chartboard.

A chartboard can be attached to the navigator's console. The board has a removable support leg. The board can be folded (up) to clear the aisle. The chartboard and leg can be removed and stowed in the baggage compartment. The board also includes a compass correction card holder.

Navigator's Console and Chartboard Light.

An adjustable eyeball-type white light and push-button switch is installed above the navigator's console. The switch is powered by the No. 2 dc secondary bus. Pushing the switch turns the light on or off.

Sextant Mount.

A mount is in the cabin ceiling on the centerline, aft of the navigator's seat. It will accept an MS28011-5 periscopic sextant. The sextant can be stowed in its case in the baggage compartment when it is not in use.

MAGNETIC COMPASS.

Refer to "Instruments" in Section I.

HEADING INDICATING SYSTEM.

The heading indicating system is a gyro-stabilized magnetic compass system that supplies heading information to the pilot, copilot, and navigator.† The system includes a remote flux detector, a compass amplifier, a directional gyro, and a slaving control and indicator. It is powered from the dc and ac essential busses and is automatically turned on when ac power is applied.

The gyro is mechanically coupled to a synchro transmitter. The electrical output of this transmitter provides position information to the horizontal situation and bearing-distance-heading indicators. The system functions in three modes. In automatic mode, the directional gyro is slaved automatically to the flux detector and airplane magnetic heading is presented on the azimuth cards of the indicators. In the directional gyro (D/G) mode, the system functions as an uncorrected directional gyro. In the manual slaving mode, the directional gyro is slaved manually to the flux

†AF60-3478 and all later airplanes

detector. The system has two slaving rates. In slow-slave, the rate is 2 to 3 degrees per minute. In fast-slave, the rate is 2 to 6 degrees per second. Slaving rate is dependent on the mode of operation employed.

Gyrocompass Mode Switch.

This guarded switch (69, figure 1-2), on the pilot's outboard instrument panel, is labeled "GYRO COMPASS." It has four labeled positions. When the guard is down, the switch is in the maintained AUTOMATIC (labeled "AUTO") position and the automatic mode of operation is selected. The guard must be raised to actuate the switch to any of the other positions.

With the switch at the maintained UP FOR DIRECTIONAL GYRO (labeled "UP FOR D/G") position,

the system operates in the directional gyro (D/G) mode. Moving the switch to the spring-loaded SLAVE LEFT or SLAVE RIGHT positions will manually slave the directional gyro to the flux detector. From either of these last positions, the switch will return to the UP FOR DIRECTIONAL GYRO position when released. [Refer to "Operation of Heading Indicating System in Directional Gyro (D/G) Mode," in this section, for information on the heading indicating system when used in the (D/G) mode.]

On some airplanes, initial fast slaving occurs when power is supplied to the directional gyro with the gyrocompass switch at AUTOMATIC. On other airplanes, fast slaving will not take place until the gyrocompass switch is moved up to UP FOR DIRECTIONAL GYRO, and then placed at AUTOMATIC. In either airplane, fast slaving continues until the gyro is properly slaved to the flux detector, at which time the system then reverts to the slow-slave rate. In the manual mode, the system fast-slaves as long as the gyrocompass switch is held at either SLAVE LEFT or SLAVE RIGHT.

Compass Slaving Indicator.

A meter-type indicator (5, figure 1-2), on the pilot's outboard instrument panel, indicates whether the directional gyro is slaved to the flux detector and, if not, in which direction the error exists. The indicator includes a pointer and scale. The scale has a center-scale mark, a dot to the left, and a plus sign to the right. Displacement of the pointer from center indicates an error between directional gyro and flux detector. Full-scale displacement, right or left, indicates about a 10-degree error between gyro and flux detector.

When the pointer is to the right of center, the mode switch must be moved to SLAVE LEFT to synchronize the gyro and flux detector. With the pointer to the left, the mode switch must be moved to SLAVE RIGHT to synchronize the units.

NOTE A slight mid-scale oscillation of the pointer indicates proper operation of the heading indicator system.

The slaving indicator will indicate any existing error between the directional gyro and the flux detector in automatic and (D/G) modes of operation.

Operation of Heading Indicating System in Directional Gyro (D/G) Mode.

The directional gyro (D/G) mode is designed for use at latitudes above 75 degrees for grid navigation, where magnetic compass indications are unreliable. Gyro precession rate, Coriolis force (earth's rotation effect), and meridian convergency will affect the accuracy of navigation in the polar latitudes. It is necessary to know grid navigation and the use of the sextant to obtain headings in polar latitudes.

Precession rate can be a maximum of ±2 degrees per 15 minutes. The significance of precession can be shown by the following example: Assume a constant heading for one hour at a ground speed of 400 knots is to be flown. Also assume the precession rate in one hour is 5 degrees. At the end of the hour, an off course of about 34 nautical miles could be encountered, because of this drift error alone. For this reason, the gyro should be rated for at least 10-minute legs on the headings to be flown, and the average precession should be applied to reduce this error.

The error due to Coriolis force is equal to 15 degrees per hour times the sine of the latitude. Thus, at a latitude of 80 degrees, the error would be 15 degrees times 0.98481, or approximately 14 degrees 46 minutes per hour. This force moves the plane to the right of course in the northern hemisphere and to the left in the southern hemisphere.

The convergency of successive meridians crossed by the airplane results in an error which is a function of ground speed, ground track, and flight latitude.

The sum of the errors caused by Coriolis force, precession, and convergency can be significant during prolonged flight in the D/G mode. Consequently, it is important to frequently verify your position by such means as visual reference, radar fix, and/or celestial fix. The system can then be slaved to a corrected reading in the D/G mode.

In latitudes where the magnetic compass is reliable, the D/G mode may be used to maintain accurate airplane heading should the remote flux detector fail. This is accomplished by slaving to the heading obtained from the magnetic compass after applying compass card correction and the gyro's precession, if known.

Emergency Operation of Heading Indicating System.

Failure of the heading indicating system in the automatic mode will be indicated by erratic presentations of the HSI compass card or "freezing" of the compass card. If failure is indicated, it may be possible to use the system in the D/G mode. When the D/G mode is selected, a check should be made to see if the compass card responds to turns. In addition, the heading information on the compass card should be checked periodically against the slaving indicator, and the system manually slaved as necessary to correct gyro drift errors. (The compass card indications should also be checked against the magnetic compass, to determine whether the system gyro is properly slaved to the flux detector.)

MARKER BEACON RECEIVER - 51Z-2 OR 51Z-3.

The marker beacon receiver provides visual and aural indication of the passage of the airplane over a 75-megacycle marker beacon transmitter. It is used as a navigation and landing aid. The system includes the receiver, a sensitivity control, and indicator lights. The system is powered from the dc essential bus and is automatically turned on when that bus is energized and the radio and instrument master switch is at ON. Aural signals, when received, will be heard, provided the applicable intercommunication control panel "MARKER" (or "MKR" or "MKR NAV") mixer switch is forward (ON).

Marker Beacon Sensitivity Switch.

This switch (7, figure 1-2), on the pilot's outboard instrument panel, has two positions. With the switch at HIGH (labeled "HI"), the receiver has maximum sensitivity to marker beacon transmitter signals. With the switch at LOW (labeled "LO"), receiver sensitivity is reduced. For a given signal strength from a marker beacon transmitter, aural tone volume will be greatest with the switch at HIGH.

Marker Beacon Lights.

A set of three lights (8 and 34, figure 1-2), on both the pilot's outboard and copilot's outboard instrument panels, presents visual indication of passage over a marker beacon.

The left-hand light on each panel will identify passage over an airway marker and, when illuminated, is white with the letter "A" appearing within the light. The aural signal associated with the airway marker beacon is a 3000 cps tone. The middle light will identify passage over a middle marker and, when illuminated, is amber with the letter "I" appearing within the light. The aural signal associated with the middle marker beacon is a 1300 cps tone.

The right-hand light will identify passage over an outer marker and, when illuminated, is blue with the letter "O" appearing within the marker light. The aural signal associated with the outer beacon is a 400 cps tone.

NOTE The position of the "MARKER" mixer switches will not affect operation of the marker beacon lights.

- A dimmable, press-to-test marker beacon light on the copilot's course indicator is not used with this set.

TACAN - AN/ARN-21C.

The TACAN set is a tactical air navigation system which provides cockpit displays of distance and bearing to a TACAN station. Slant range of the set is line-of-sight up to approximately 195 nautical miles. The Morse code which identifies the station is audible in the headsets. Major components of the set are a receiver-transmitter, an indicator coupler, and a control panel. Distance, bearing, and course signals from the receiver-transmitter are sent to the indicator coupler, which processes the signals and couples them to the various cockpit indicators. The set is powered by the dc essential bus and the 115-volt nonessential ac bus.

NOTE In flight, cross-check the TACAN bearing information periodically against other navigation equipment. This is necessary because improperly adjusted or malfunctioning TACAN equipment may result in lock-on to a false bearing. The error will probably be plus or minus 40 degrees, but may be any value which is a multiple of 40 degrees, and can be to either side of the correct bearing.

- Allow 3 minutes for TACAN warm-up.

When the TACAN locks on a false bearing, switching to another channel and then back to the desired channel, or turning the set off and then back on, will recycle the search mode. This will most probably result in a correct lock-on. This deficiency does not affect the DME display provided by the TACAN equipment.

Function Switch.

This rotary, three-position switch on the TACAN control panel (figure 4-9) controls power to the set and mode of operation. With the switch at RECEIVE (labeled "REC"), the system will present bearing and identification information. With the switch at TRANSMIT/RECEIVE (labeled "T/R"), the system will present bearing, distance, and identification information. When the switch is at OFF, the system is off. The switch is powered from the dc essential bus.

Channel Selector Switch.

The channel selector switch on the TACAN control panel (figure 4-9) permits selection of any one of the 126 channels for air-ground-air transmissions. These channels cover a transmitter range of 1025 to 1150 mc and a receiver frequency range of 962 to 1213 mc in one-megacycle steps. The switch consists of a large circular knob with a serrated edge and a small handle. The circular knob selects the first two digits, and the handle selects the third digit of a desired channel. Power for the switch is from the dc essential bus. A window above the handle displays the selected channel.

Volume Control Knob.

This knob on the TACAN control panel (figure 4-9)

controls the audio level of the surface beacon identification signal to the headsets.

VOR NAVIGATION/INSTRUMENT LANDING SYSTEM.

This system includes a 51X-2B VOR/localizer receiver and instrumentation unit, 51V-3 or DGS-20 glide slope receiver, and essential controls. Flight instruments which display the system information are the pilot's attitude director and horizontal situation indicators, the copilot's bearing-distance-heading and course indicators, and the navigator's† bearing-distance-heading indicator. The VOR/localizer receiver and the glide slope receiver are powered by the dc essential bus, and the VOR/localizer instrumentation unit is powered by the ac essential bus.

VOR/Localizer Glide Slope Control Panel.

This panel (figure 4-9) is on the center instrument panel. It controls operation of the VOR/localizer receiver and the glide slope receiver. It includes an on-off power switch, two frequency selector knobs, a volume control knob, a variable squelch knob mounted on coaxial shafts, and a frequency display window. Moving the power switch to ON turns on the two receivers. The two frequency selector knobs permit selection of VOR/localizer frequencies through the range of 108 to 151.95 mc in 50-kilocycle steps. The right-hand knob sets the two right-hand counter drums in the frequency window. The left-hand knob sets the three left-hand counter drums. The frequency selector knobs, when used to select a localizer frequency, will automatically tune the glide slope receiver to a compatible channel. (The glide slope receiver provides reception on 20 channels spaced 300 kilocycles apart in the range of 329.3 through 335.0 mc. However, the frequency displayed in the window will not indicate the selected glide slope receiver frequency.) The volume control knob controls the audio level of the VOR or localizer signal. Volume is increased when the knob is turned clockwise. The squelch knob controls the VOR/localizer receiver only during reception of frequencies above 117.9 megacycles. Where signals above 117.9 mc are weak, the variable squelch knob should be turned clockwise in order for the weak signal to open the squelch. Where a strong signal exists, the squelch knob should be turned counterclockwise until the background noise disappears.

FLIGHT DIRECTOR SYSTEM.

The flight director system, on the pilot's instrument panel, consists of an attitude director indicator, a horizontal situation indicator (figure 4-13), a flight director mode selector switch (67, figure 1-2), a course selector switch (68, figure 1-2), and associated performance instruments. ADF-equipped airplanes have the HSI bearing selector switch (15, figure 1-2). A CPU-4/A flight director computer drives the pitch and bank steering bars on the attitude director indicator.

CPU-4/A Flight Director Computer.

The CPU-4/A flight director computer receives signals from the pilot's MD-1 vertical gyro, VOR/localizer receiver, glide slope receiver, and horizontal situation indicator.

The computer combines heading, roll, and localizer signals in the roll channel, and pitch and glide slope signals in the pitch channel. Depending on the mode of operation selected, the computer supplies either command heading steering or computed localizer steering signals to the bank steering bar, glide slope signals to the glide slope deviation indicator, and computed glide slope steering signals to the pitch steering bar.

Figures 4-13 and 4-14 show the computer steering and deviation presentations on the attitude director indicator in the various operating modes, as well as other navigational presentations. The computer is powered from the ac and dc essential busses and is automatically turned on when these busses are energized.

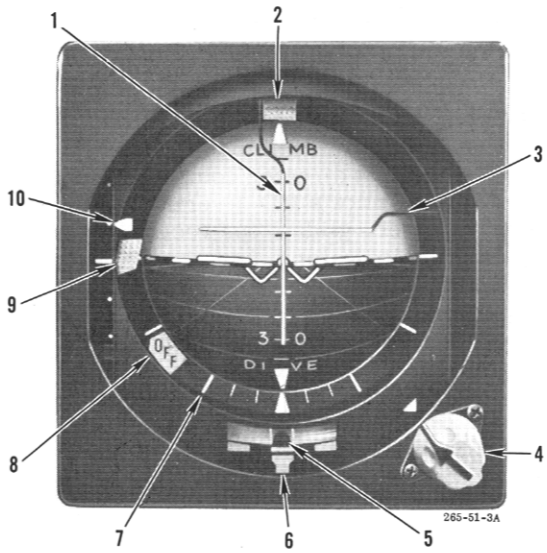
Flight Director System Controls.

FLIGHT DIRECTOR MODE SELECTOR SWITCH. This rotary switch (67, figure 1-2) is on the pilot's outboard instrument panel and receives power from the dc essential bus. It has three positions (NAV, ILS, and ILS APPR) for the three major flight director operating modes. Figures 4-13 and 4-14 show attitude director and horizontal situation indicator presentations in each major mode.

HEADING MODE SELECTOR SWITCH. This two-position switch (66, figure 1-2), on the pilot's outboard instrument panel, receives power from the dc essential bus and controls the flight director submodes of operation. It has two positions, NORMAL and MANUAL. Figures 4-13 and 4-14 show the attitude director and horizontal situation indicator presentations in each submode.

COURSE SELECTOR SWITCHES. There are two course selector switches, one for the pilot (68, figure 1-2) and one for the copilot (38, figure 1-2). Each switch has two positions, TACAN and VOR/ILS, and receives power from the dc essential bus. Figures 4-13 and 4-14 show the attitude director indicator and horizontal situation indicator presentations in each position.

†AF60-3478 and all later airplanes



FLIGHT DIRECTOR MODES

WARNING

In the absence of a usable signal (indicated by the appearance of applicable warning flag), related presentations on both indicators are unreliable.

1. BANK STEERING BAR
2. COURSE WARNING FLAG (ON SOME INSTRUMENTS, FLAG IS AT 6 O'CLOCK POSITION.)
3. PITCH STEERING BAR
4. PITCH TRIM KNOB
5. SLIP INDICATOR
6. TURN NEEDLE
7. BANK INDEX SCALE (ON SOME INSTRUMENTS, SCALE IS AT TOP.)
8. ATTITUDE WARNING FLAG
9. GLIDE SLOPE WARNING FLAG
10. GLIDE SLOPE INDICATOR

MAJOR MODE (FLIGHT DIRECTOR MODE SWITCH)	HEADING SUBMODE (HEADING MODE SELECTOR SWITCH)	PILOT'S COURSE SELECTOR SWITCH	ATTITUDE DIRECTOR INDICATOR				
			GLIDE SLOPE INDICATOR	BANK STEERING BAR	PITCH STEERING BAR	COURSE WARNING FLAG	GLIDE SLOPE WARNING FLAG
NAV	NORMAL	VOR/ILS	OUT OF VIEW	OUT OF VIEW	OUT OF VIEW	OUT OF VIEW WITH USABLE VOR SIGNAL	OUT OF VIEW
		TACAN				OUT OF VIEW WITH USABLE TACAN SIGNAL	OUT OF VIEW
	MANUAL	VOR/ILS	OUT OF VIEW	COMMAND HEADING STEERING	OUT OF VIEW	OUT OF VIEW WITH USABLE VOR SIGNAL	OUT OF VIEW
		TACAN				OUT OF VIEW WITH USABLE TACAN SIGNAL	OUT OF VIEW
ILS	NORMAL	VOR/ILS	GLIDE SLOPE DEVIATION	LOCALIZER STEERING	OUT OF VIEW	OUT OF VIEW WITH USABLE LOCALIZER SIGNAL	OUT OF VIEW WITH USABLE GLIDE SLOPE SIGNAL
		TACAN					
	MANUAL	VOR/ILS	GLIDE SLOPE DEVIATION	COMMAND HEADING STEERING	OUT OF VIEW	OUT OF VIEW WITH USABLE LOCALIZER SIGNAL	OUT OF VIEW WITH USABLE GLIDE SLOPE SIGNAL
		TACAN					
ILS APPROACH	NORMAL	VOR/ILS	GLIDE SLOPE DEVIATION	LOCALIZER STEERING	GLIDE SLOPE STEERING	OUT OF VIEW WITH USABLE LOCALIZER SIGNAL	OUT OF VIEW WITH USABLE GLIDE SLOPE SIGNAL
		TACAN					
	MANUAL†	VOR/ILS	GLIDE SLOPE DEVIATION	COMMAND HEADING STEERING	OUT OF VIEW	OUT OF VIEW WITH USABLE LOCALIZER SIGNAL	OUT OF VIEW WITH USABLE GLIDE SLOPE SIGNAL
		TACAN					

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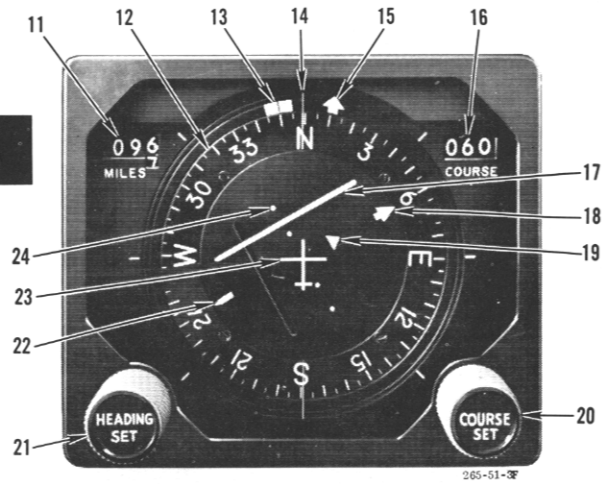
Figure 4-13

.....and Pilot Indicator Presentations

11. RANGE INDICATOR
12. COMPASS CARD
13. HEADING MARKER
14. LUBBER LINE
15. BEARING POINTER †
16. COURSE SELECTOR WINDOW (COURSE COMMAND)
17. COURSE DEVIATION INDICATOR
18. COURSE ARROW (HEAD)
19. TO-FROM INDICATOR
20. COURSE SET KNOB
21. HEADING SET KNOB
22. COURSE ARROW (TAIL)
23. AIRCRAFT SYMBOL
24. COURSE DEVIATION SCALE



HORIZONTAL SITUATION INDICATOR

HEADING MARKER	COURSE COMMAND	COURSE DEVIATION INDICATOR	TO-FROM INDICATOR	BEARING POINTER †	RANGE INDICATOR
SET BY PILOT	SET BY PILOT	VOR DEVIATION	FUNCTION OF VOR SIGNAL	VOR BEARING	TACAN RANGE
SET BY PILOT	SET BY PILOT	TACAN DEVIATION	FUNCTION OF TACAN SIGNAL	TACAN BEARING	TACAN RANGE
SET BY PILOT	SET BY PILOT	VOR DEVIATION	FUNCTION OF VOR SIGNAL	VOR BEARING	TACAN RANGE
SET BY PILOT	SET BY PILOT	TACAN DEVIATION	FUNCTION OF TACAN SIGNAL	TACAN BEARING	TACAN RANGE
SET BY PILOT	SET BY PILOT TO PUBLISHED LOCALIZER FRONT APPROACH COURSE	LOCALIZER DEVIATION	OUT OF VIEW	SERVOED TO LUBBER LINE	TACAN RANGE
		LOCALIZER DEVIATION	OUT OF VIEW	TACAN BEARING	TACAN RANGE
SET BY PILOT	SET BY PILOT TO PUBLISHED LOCALIZER FRONT APPROACH COURSE	LOCALIZER DEVIATION	OUT OF VIEW	SERVOED TO LUBBER LINE	TACAN RANGE
		LOCALIZER DEVIATION	OUT OF VIEW	TACAN BEARING	TACAN RANGE
SET BY PILOT	SET BY PILOT TO PUBLISHED LOCALIZER FRONT APPROACH COURSE	LOCALIZER DEVIATION	OUT OF VIEW	SERVOED TO LUBBER LINE	TACAN RANGE
		LOCALIZER DEVIATION	OUT OF VIEW	TACAN BEARING	TACAN RANGE
SET BY PILOT	SET BY PILOT TO PUBLISHED LOCALIZER FRONT APPROACH COURSE	LOCALIZER DEVIATION	OUT OF VIEW	SERVOED TO LUBBER LINE	TACAN RANGE
		LOCALIZER DEVIATION	OUT OF VIEW	TACAN BEARING	TACAN RANGE

† On airplanes changed by T.O. 1T-39A-534 or -544, ADF bearing will be shown at all times when the "HSI BEARING" selector switch is in the ADF BRG position.

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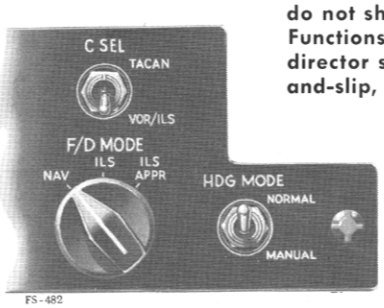
NOTE

These presentations presume a straight and level flight condition and show various types of indications in various operating modes. They do not show specific navigation procedures. Functions not directly related to the flight director system presentations, such as turn-and-slip, are not covered here.

ADI AND HSI



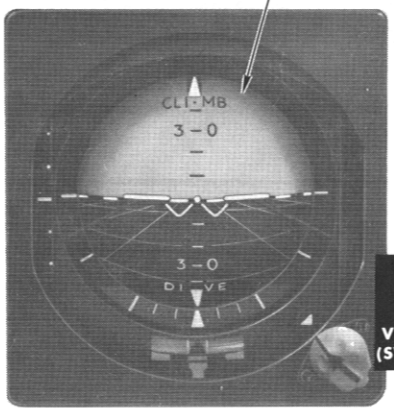
† BEARING POINTER—VOR OR TACAN BEARING †

RANGE INDICATOR—TACAN SLANT RANGE

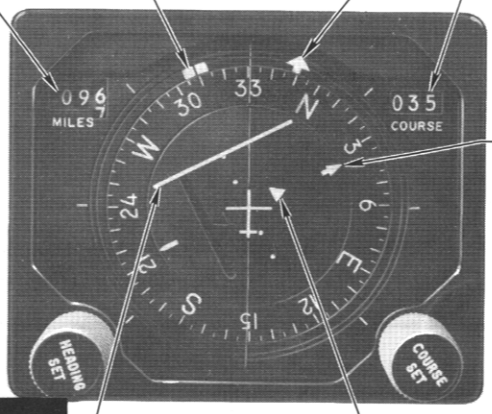
HEADING MARKER—COMMAND HEADING SET BY PILOT

COURSE SELECTOR WINDOW—READOUT OF COURSE COMMAND SET BY PILOT

ATTITUDE INDICATOR ONLY IN THIS MODE



ADI



HSI

COURSE ARROW—COURSE COMMAND SET BY PILOT

NAV • NORMAL • VOR/ILS OR TACAN (SWITCH POSITIONS)

COURSE DEVIATION INDICATOR—VOR OR TACAN COURSE DEVIATION

TO-FROM INDICATOR—VOR OR TACAN TO-FROM INDICATION

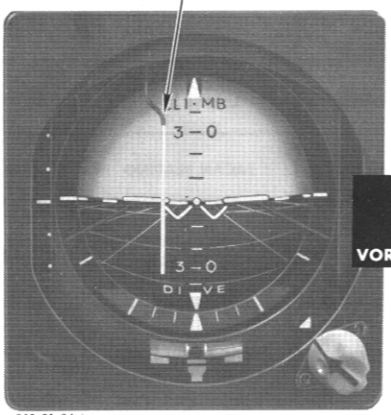
RANGE INDICATOR—TACAN SLANT RANGE

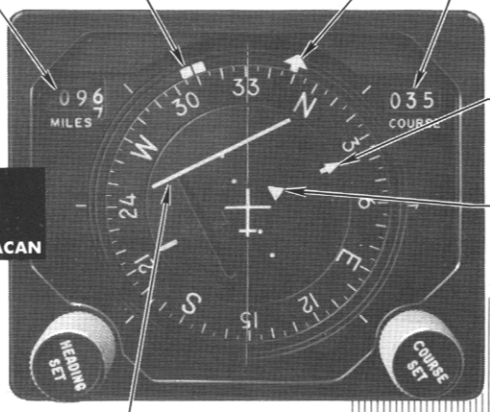
BEARING POINTER—VOR OR TACAN BEARING †

HEADING MARKER—COMMAND HEADING SET BY PILOT

COURSE SELECTOR WINDOW—READOUT OF COURSE COMMAND SET BY PILOT

BANK STEERING BAR—COMMAND HEADING STEERING





COURSE ARROW—COURSE COMMAND SET BY PILOT

NAV • MANUAL • VOR/ILS OR TACAN

TO-FROM INDICATOR—VOR OR TACAN TO-FROM INDICATION

265-51-3C

COURSE DEVIATION INDICATOR—VOR OR TACAN COURSE DEVIATION

† On airplanes changed by T.O. 1T-39A-534 or -544, ADF bearing will be shown at all times when the "HSI BEARING" selector is in the ADF BRG position.

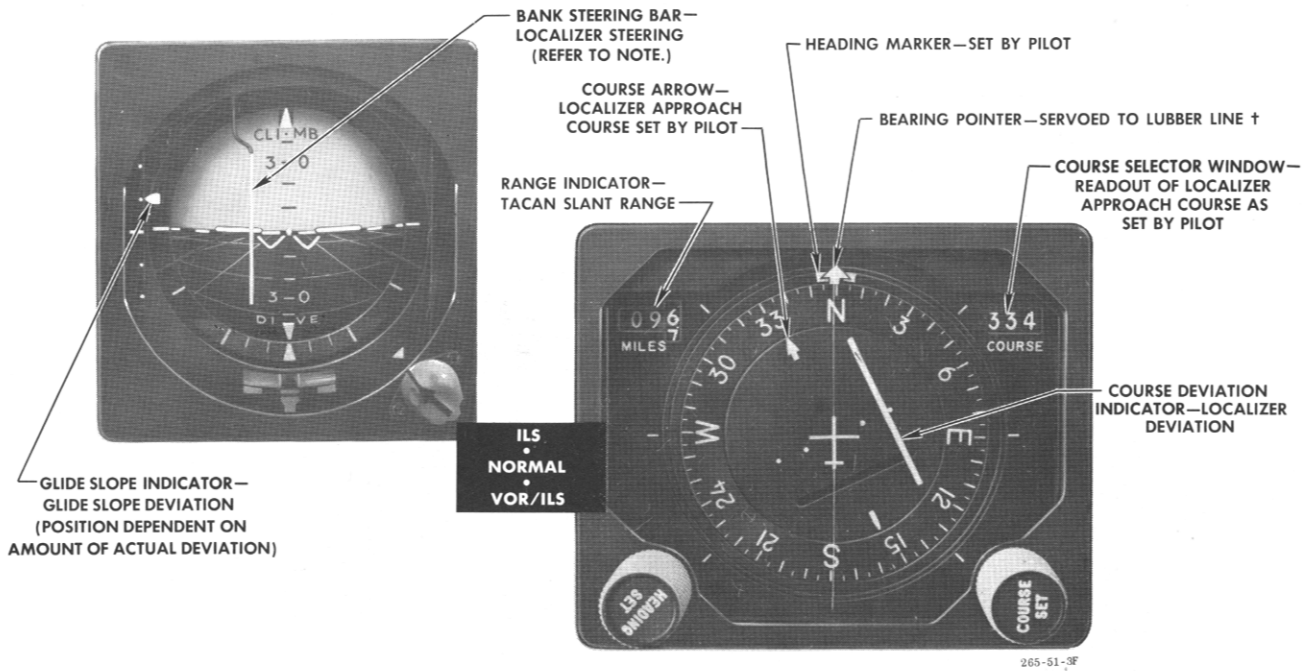
39A-1-71-5E

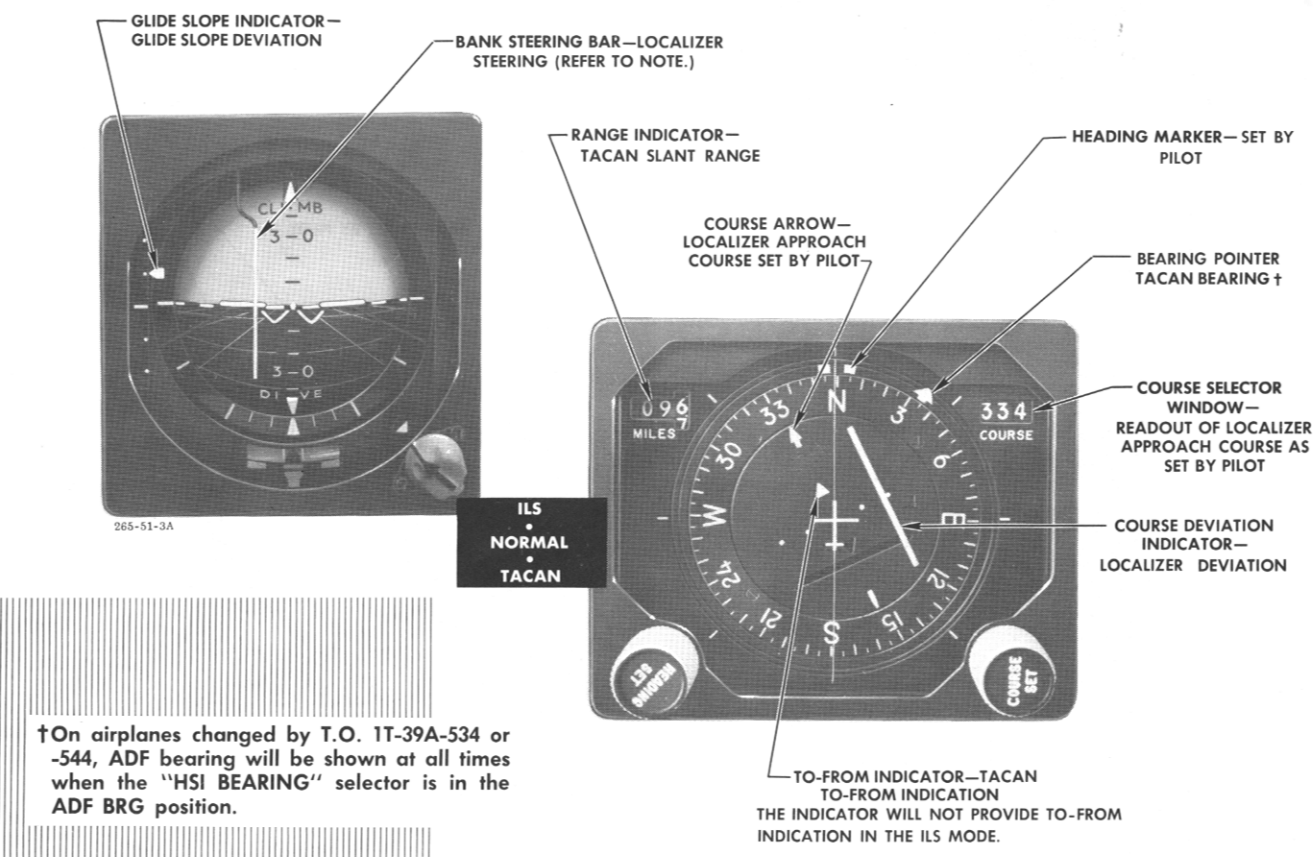
Figure 4-14 (Sheet 1 of 3)

NAVIGATION PRESENTATIONS

NOTE

With heading mode switch at *MANUAL*, the ADI bank steering bar will show command heading steering and the HSI heading marker will show the command heading set by the pilot.





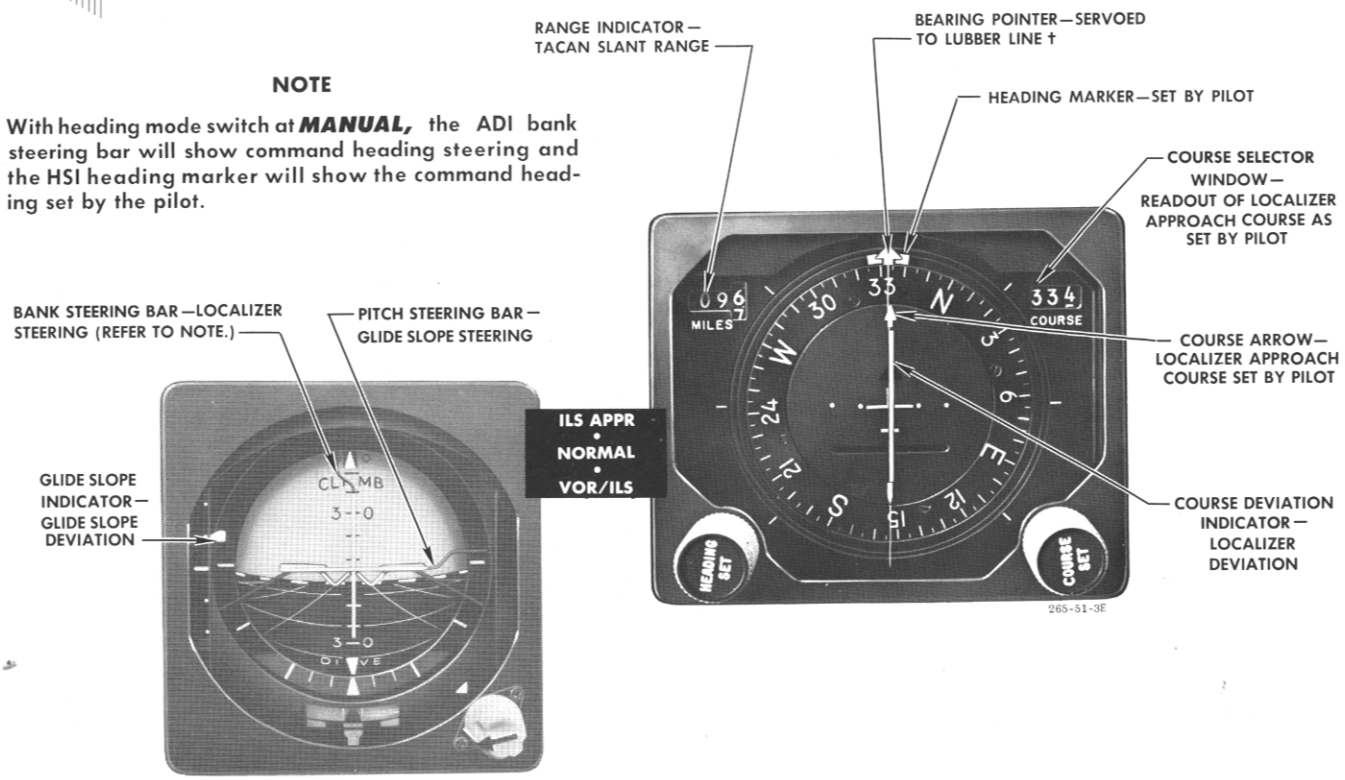
†On airplanes changed by T.O. 1T-39A-534 or -544, ADF bearing will be shown at all times when the "HSI BEARING" selector is in the ADF BRG position.

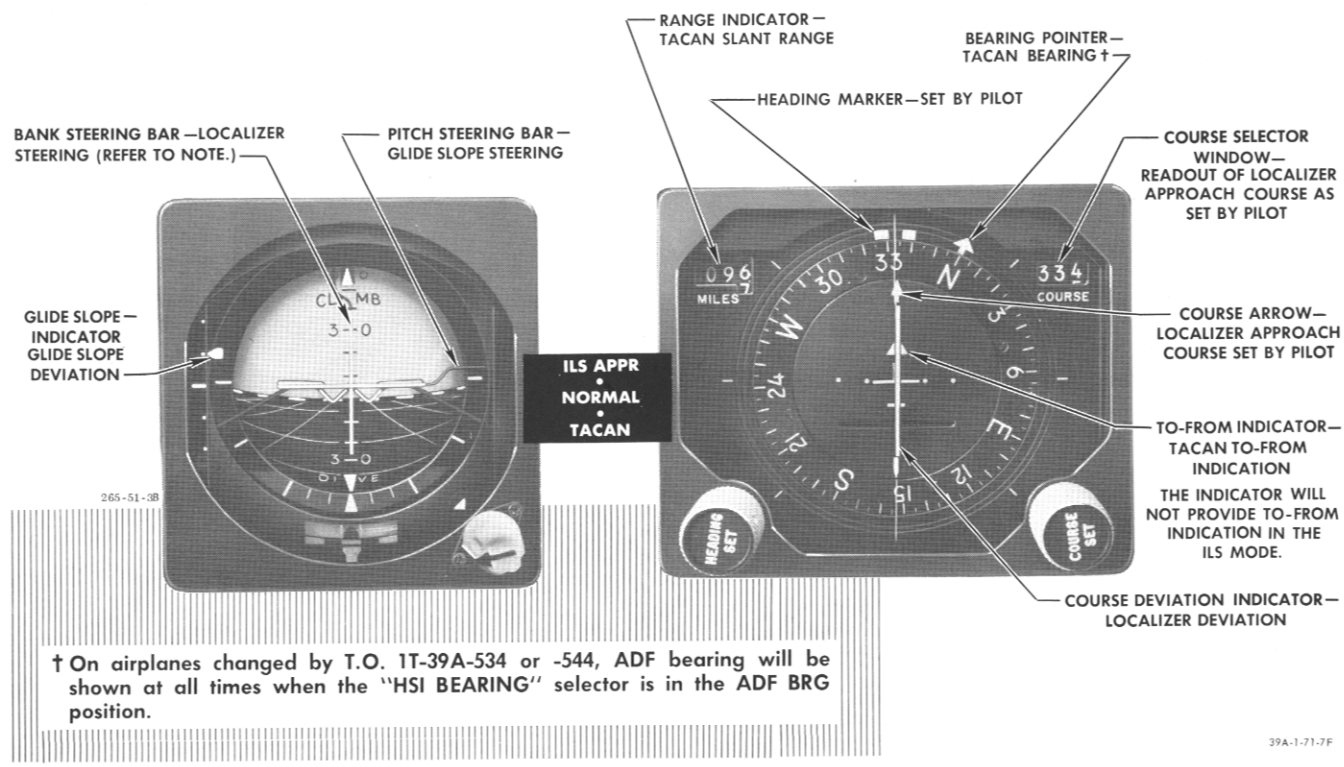
Figure 4-14 (Sheet 2 of 3)

ADI AND HSI NAVIGATION PRESENTATIONS

NOTE

With heading mode switch at ***MANUAL,*** the ADI bank steering bar will show command heading steering and the HSI heading marker will show the command heading set by the pilot.





† On airplanes changed by T.O. 1T-39A-534 or -544, ADF bearing will be shown at all times when the "HSI BEARING" selector is in the ADF BRG position.

39A-1-71-7F

Figure 4-14 (Sheet 3 of 3)

Flight Director System Indicators.

ATTITUDE DIRECTOR INDICATOR (ADI). The attitude director indicator (11, figure 1-2; figure 4-13) is a multipurpose instrument powered by the ac essential bus. In addition to serving as an attitude indicator, the ADI presents turn-and-slip information, ILS glide slope displacement, and computed steering information relative to a selected mode of the flight director system. The computed steering presentations, provided by pitch and bank steering bars superimposed over the attitude sphere, are shown in figures 4-13 and 4-14 for the various operating modes.

Attitude indications presented by the sphere are functionally the same as the copilot's MM-3 attitude indicator except that the bank scale is at the bottom of the instrument adjacent to the turn-and-slip indicator. Thus, during a turn, the bank pointer and turn needle are displaced in the same direction as the airplane is turning.

NOTE The ARU-2B/A ADI is interchangeable with an earlier (ARU-2A/A) model. The only significant difference in presentation is that the bank scale on the ARU-2A/A ADI is at the top of the instrument.

The attitude sphere is operated by signals received from an MD-1 vertical gyro. If power fails in the vertical gyro or the ADI, an attitude warning flag (8, figure 4-13) appears in the lower left corner. The flag should disappear within 90 seconds upon initial application of power to the vertical gyro.

Warning The attitude warning flag will not appear when there is a slight electrical power reduction or failure of other components within the system. Although a rare occurrence, failure of certain components can result in erroneous or complete loss of pitch and bank presentations without a visible flag.

A pitch-trim knob (4, figure 4-13) electrically positions the attitude sphere to provide the desired pitch presentation relative to the fixed miniature aircraft. The turn needle receives signals from a rate gyro and is calibrated so that one needle-width deflection equals 1-1/2 degrees-per-second rate of turn.

The bank steering bar presents azimuth steering information in relation to an airplane heading or an ILS localizer course in accordance with signals supplied by the flight director computer. The position of the flight director mode selector switch and the heading mode selector switch determines the information presented (figure 4-13). When using the bank steering bar for either of these purposes, the airplane must be steered in the direction the bank steering bar is displaced from center. Keeping the bank steering bar centered provides the amount of bank required to roll in, turn, roll out, and maintain the selected airplane heading or localizer course.

NOTE Except for the ILS APPR mode, the flight director computer steering signals are such that the maximum airplane bank angle required to center the bar is 35 degrees. For ILS APPR, the maximum bank angle required is 15 degrees. In addition, automatic wind drift is provided by the bank steering bar when in the ILS APPR mode.

The glide slope indicator (10, figure 4-13) presents the glide slope position in relation to the airplane in ILS and ILS APPR modes. The airplane is on the glide slope when the glide slope indicator is aligned with the center index. The pitch steering bar presents pitch steering information from signals received by the flight director computer in relation to the ILS glide slope. The pitch steering bar is out of view in all but the ILS APPR - NORMAL modes.

Two warning flags, in addition to the attitude warning flag, are provided on the ADI for monitoring navigational signal strength. A course warning flag (2, figure 4-13) appears at the top of the ADI whenever electrical signals from the selected navigational receiver are weak or unreliable. A glide slope warning flag (9, figure 4-13) appears at the center index of the glide slope scale whenever the signals from the glide slope receiver are weak or unreliable. (This flag is electrically driven from view in the NAV mode of operation.)

NOTE Although the course and glide slope warning flags are positioned on the ADI near the pitch and bank steering bars, they do not warn of pitch and bank steering bar malfunction.

HORIZONTAL SITUATION INDICATOR (HSI). The HSI (9, figure 1-2; figure 4-13) is a multipurpose instrument powered by the ac essential bus. It displays airplane heading and navigational information relative to selected modes of the flight director system. There are no warning flags on this instrument.

The airplane heading is displayed on a rotary compass card (12, figure 4-13). Operation of the heading indicating system is controlled by the gyrocompass mode switch (69, figure 1-2). A correction card (8, figure 1-3) for the HSI compass card is above the left console. For operation of the compass system, refer to heading indicating system in this section.

The heading marker (13, figure 4-13) may be positioned about the compass card by use of the heading set knob. Once positioned, the marker remains

fixed relative to the card. For information on use of the heading marker, refer to "Normal Operation of Flight Director System."

The course arrow (18, figure 4-13) may be positioned about the compass card by use of the course set knob (20, figure 4-13). The course set knob simultaneously positions the course arrow and the course selector window. The course selector window (16, figure 4-13) contains a three-digit display and always reads the same as the head of the course arrow. Once positioned, the course arrow remains fixed relative to the compass card. The course deviation indicator (17, figure 4-13), which consists of the center section of the course arrow, displays angular and lateral deviation from the selected course. The course arrow represents the selected course; the CDI, a segment of that course. Thus, the relationship between the course arrow, CDI, and aircraft symbol (23, figure 4-13) presents a pictorial plan view of the navigation problem.

The bearing pointer (15, figure 4-13) indicates the magnetic bearing to the selected VOR, TACAN, and, on some airplanes, ADF station. The "TO-FROM" indicator (19, figure 4-13) indicates whether the selected course, if flown, will take the airplane to or from a selected VOR or TACAN station. If the "TO-FROM" indicator points to the head of the course arrow, the selected course will take the airplane to the station; conversely, if the "TO-FROM" indicator points to the tail of the course arrow, the course selected will take the airplane from the station. The "TO-FROM" indicator will not be in view in the ILS or ILS APPR modes of flight director operation.

NOTE In ADF-equipped airplanes, the following display combination occurs simultaneously when the HSI selector switch is in the ADF BRG position and TACAN, VOR, and ILS frequencies are selected. The bearing pointer indicates magnetic bearing to the ADF station, the CDI indicates VOR/ILS displacement, and the range indicator indicates slant range distance to the TACAN station.

The range indicator (11, figure 4-13) reads slant range in nautical miles to the selected TACAN station and is displayed in all modes of flight director operation.

Flight director system presentations in the various operating modes are shown in figures 4-13 and 4-14.

BEARING-DISTANCE-HEADING INDICATOR (BDHI). The BDHI (35, figure 1-2) is a multipurpose instrument powered by the No. 2 26-volt ac bus and the dc essential bus. Most airplanes† include a BDHI on the navigator's console. The BDHI consists of a rotating compass card (which is servoed to the heading indicating system), a VOR bearing pointer, a TACAN bearing pointer, a range indicator, and a range indicator warning flag. The compass card rotates as the airplane turns, so that the magnetic heading of the airplane is under the index at the top of the instrument. The bearing pointers will either be numbered "1" and "2" or be single- and double-barred. Placards below the instrument identify which bearing pointer presents TACAN and VOR bearings. On ADF-equipped airplanes, the TACAN bearing pointer may be used for ADF bearing information when the No. 1 pointer switch is in the ADF BRG position. A correction card (11, figure 1-4)

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for the BDHI compass card is above the right console.

NOTE On early airplanes (AF59-2868 through -2872 and AF61-634 through -635), erratic or weak VOR reception may cause a signal feed-back from the No. 2 pointer to the BDHI compass card, causing the card to oscillate. If this appears to be happening, correct by turning the VOR off or by tuning in a station which provides a positive lock-on.

COURSE INDICATOR. The course indicator (42, figure 1-2), on the copilot's instrument panel, is powered from the No. 2 26-volt ac bus. The course information presented on this instrument is dependent upon the position of the pilot's and copilot's course selector switches. When both "C SEL" switches are in the same position, the course selection feature of the course set knob is inoperative, and the CDI presentations on the course indicator are those selected by the pilot on the HSI. In addition, the "COPILOT C SEL INOP" caution light

†AF60-3478 and all later airplanes

comes on. To regain normal operation of the course indicator, the copilot's "C SEL" switch must be placed at the position opposite the position used by the pilot's "C SEL" switch.

Warning With the pilot's "C SEL" switch at VOR/ILS and the copilot's "C SEL" switch at TACAN (TACAN and ILS frequencies selected), the CDI presents TACAN course information and the glide slope indicator presents glide slope information.

NOTE The marker beacon light on the course indicator has no function and is inoperative on this airplane.

PILOT'S COURSE SELECT FAIL CAUTION LIGHT. This placard-type amber caution light (14, figure 1-26) is on the pilot's outboard instrument panel. The light receives power through the pilot's course selector switch and, when illuminated, reads "PILOT C SEL FAIL." When this light comes on, a failure of a switching relay in the indicator switching package is indicated. Under this condition, the navigation presentations on the ADI and HSI must be considered unreliable.

COPILOT'S COURSE SELECT FAIL CAUTION LIGHT. This amber, placard-type caution light (9, figure 1-26) is on the copilot's outboard instrument panel. The light receives power through the copilot's course selector switch and, when illuminated, reads "COPILOT C SEL FAIL." When this light comes on, a failure of a switching relay in the indicator switching package is indicated. Under this condition, the navigation presentations on the course indicator must be considered unreliable.

COPILOT'S COURSE SELECT INOPERATIVE CAUTION LIGHT. This amber, placard-type caution light (9, figure 1-26) is on the copilot's outboard instrument panel. The light receives power through the pilot's course selector switch and, when illuminated, reads "COPILOT C SEL INOP." This light will come on when the pilot's and copilot's course selector switches are at the same position and will indicate that the copilot cannot select a desired course on the course indicator. In addition, while the light is on, the navigation presentations on the course indicator will be those selected by the pilot.

Normal Operation of Flight Director System.

TURNS TO, AND MAINTAINING, HEADING. To select and fly a particular magnetic heading using the bank steering bar or heading marker, proceed as follows:

1. Flight director mode selector switch - NAV.

2. Heading mode selector switch - NORMAL or MANUAL, as desired.

3. Gyrocompass mode switch - AUTOMATIC.

   Check gyrocompass mode switch at AUTOMATIC and that HSI compass card magnetic heading indication is correct (slaving indicator centered).

4. Heading set knob - Set.

   Rotate heading set knob to align heading marker with desired magnetic heading on compass card.

5. Airplane - Turn to desired heading.

   a. If heading mode selector switch is at NORMAL, turn airplane to center heading marker under lubber line, rolling out of turn as heading marker centers under lubber line.

   b. If heading mode selector switch is at MANUAL, bank airplane into turn to center bank steering bar. Reduce bank angle as necessary to keep bank steering bar centered, and roll-out will be complete when desired heading is reached. Maintain heading by keeping bank steering bar centered.

NOTE In this submode of operation, the indications given in step 5. a. also will occur.

TACAN OR VOR NAVIGATION. To fly a selected TACAN or VOR course, proceed as follows:

1. TACAN or VOR receiver - Select desired frequency.

2. Flight director mode switch - NAV.

3. Heading mode selector switch - NORMAL.

4. Pilot's course selector switch - TACAN or VOR/ILS.

5. Pilot's course select fail light - Check out.

6. Course set knob - Set.

   Rotate course set knob until head of course arrow is aligned with desired course on compass card. The course window should indicate the same course, and the course deviation indicator should show the airplane deviation from the selected course.

7. Intercept heading - Establish.

   The intercept heading to be flown should be determined on the basis of prescribed instrument flying techniques.

8. Course deviation indicator - Monitor.

Check course deviation indicator movement toward airplane symbol. As deviation indicator approaches airplane symbol, turn airplane to heading of selected course.

9. Course deviation indicator - Check.

Check position of course deviation indicator. If indicator is offset, indicating overshoot or undershoot, steer airplane toward indicator to center it.

10. Wind drift correction - Check.

If wind causes the airplane to drift off course, steer to keep indicator centered.

NOTE If desired, the bank steering bar may be used to maintain airplane heading after wind drift correction has been established.

11. Distance from station - Check.

If using TACAN function, check range indicator as necessary to determine distance from station. (The TACAN function switch must be at T R to obtain distance indications.)

ILS Approach.

The following operating procedure shows the normal method of using the flight director system to intercept a localizer course and glide slope in conjunction with an ILS approach. Specific instrument flight procedures, which vary from base to base, are not considered.

1. VOR/ILS receiver - Select localizer frequency and identify station.

2. Heading mode selector switch - NORMAL.

3. Pilot's course selector switch - As required.

NOTE With the pilot's course selector switch in the TACAN position (flight director mode switch at ILS or ILS APPR), TACAN bearing and range will be obtained simultaneously with ILS course and glide slope information. (See figure 4-13.)

4. Pilot's course select fail light - Check out.

NOTE If the light is on, ADI and HSI navigational presentations should be considered unreliable.

5. Course set knob - Set.

Rotate the course set knob to set localizer front approach course in the course selector window. The head of the course arrow should point to the same course on the compass card.

NOTE The published front approach course must be set in the course selector window for all ILS approaches to obtain accurate directional indications on the HSI course deviation indicator.

6. Flight director mode switch - ILS, to obtain steering information from bank steering bar.

7. Bank steering bar - Center.

When the airplane heading is within 90 degrees of the published front approach course, steer airplane as necessary to keep bar centered. The steering bar should provide an intercept angle to the localizer course of 45 degrees and, when the course is approached, command a turn inbound to place the airplane on the localizer course.

Warning The bank steering bar may only be used for a front course approach and cannot be used for a back course approach.

- If the published front course has not been set in the course selector window, the bank steering bar will be unreliable.

8. Course deviation indicator - Check.

When roll-out on localizer front approach course is complete, check that course deviation indicator is centered under airplane symbol, indicating airplane is on localizer course.

NOTE The prelanding check should be made before intercepting the glide slope.

9. Flight director mode switch - ILS APPR.

When the flight director mode switch is moved from ILS to ILS APPR, the maximum bank angle required to center the bank steering bar is reduced from 35 to 15 degrees. This bank angle limit will automatically restrict corrective maneuvering which may be required to keep the airplane on the localizer approach course.

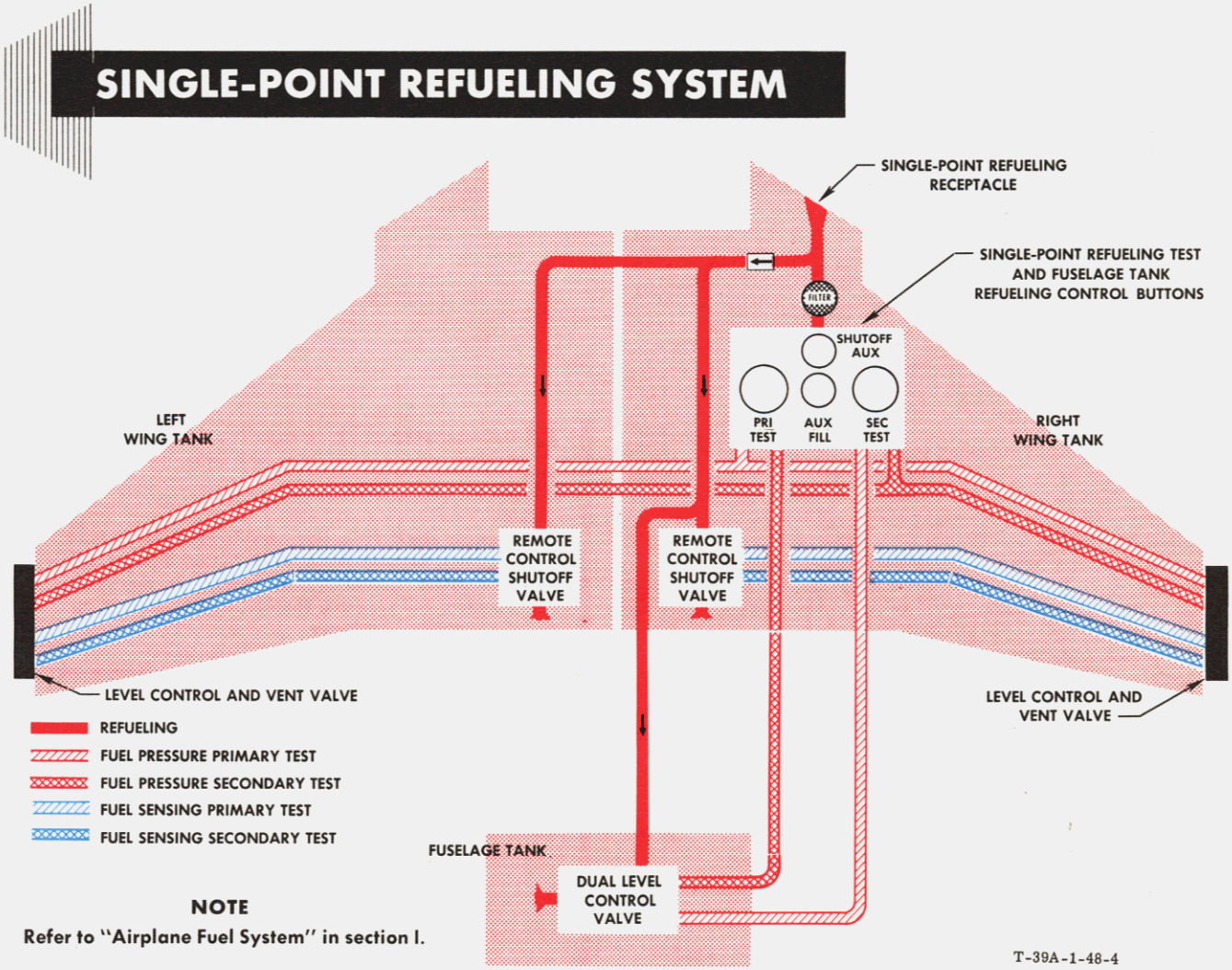


Figure 4-15

NOTE In this mode, wind-drift corrections will be accomplished automatically. Consequently, centering the bank steering bar will result in an airplane flight path along the centerline of the localizer approach course.

- The pitch steering bar will come into view when switching to ILS APPR. However, pitch steering corrections should not be made at this time.

10. Glide slope indicator - Monitor.

    While flying airplane on localizer approach course, monitor glide slope indicator. When indicator approaches center, proceed to step 11. (The position of the glide slope indicator when pitch steering is initiated will depend primarily on pilot technique, but should not exceed one dot displacement.)

11. Pitch steering bar - Center.

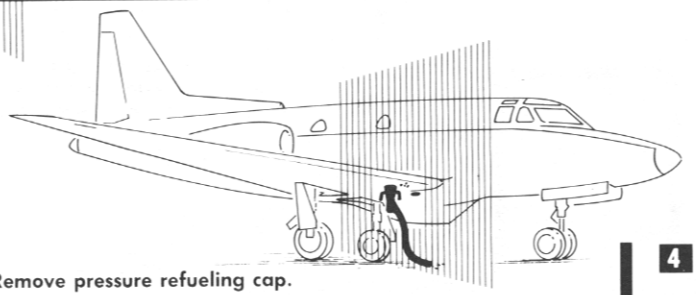
    Adjust airplane pitch attitude to center pitch steering bar.

NOTE Cross-check as necessary to glide slope indicator and course deviation indicator, to ensure airplane is on course and glide slope.

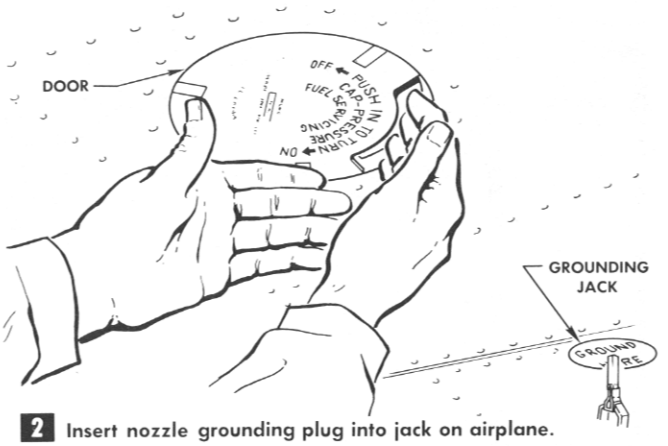
SINGLE-POINT REFUELING SYSTEM.

The single-point refueling system permits all internal fuel tanks to be filled on the ground by means of a pressure refueling system connected to a single-point refueling receptacle (figure 1-31) on the right wing, inboard, below the leading edge. If a refueling pressure of approximately 50 psi is maintained, the wing tanks fill in approximately 11 minutes, and all tanks fill in about 12 minutes. The system consists of one remote-control shutoff valve and one level control and vent valve in each wing, one dual level control valve in the fuselage tank, a pressure refueling test and fuselage

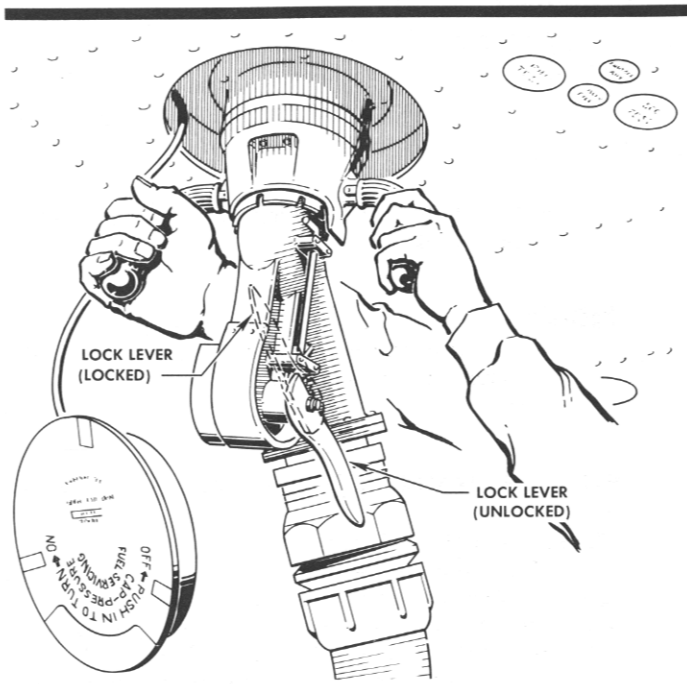
SINGLE-POINT REFUELING



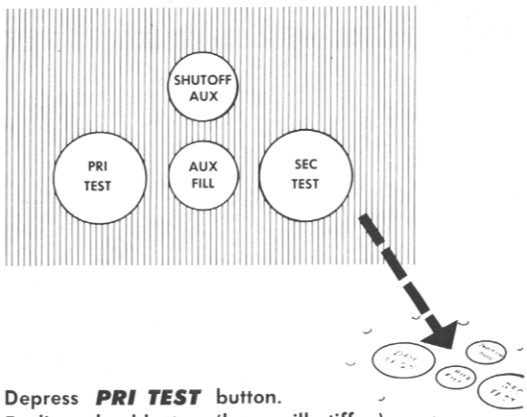
1 Remove pressure refueling cap.



2 Insert nozzle grounding plug into jack on airplane.



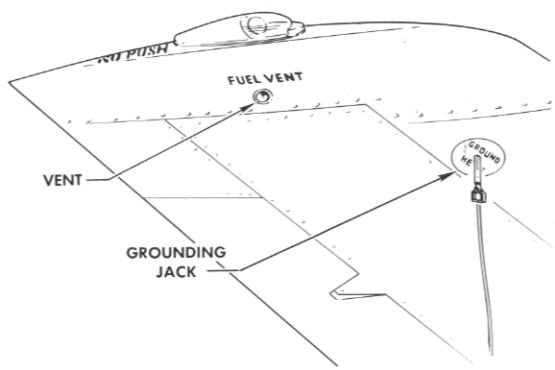
3 Connect and lock refueling nozzle. Start ground servicing unit. Refueling pressure should be 50 psi.



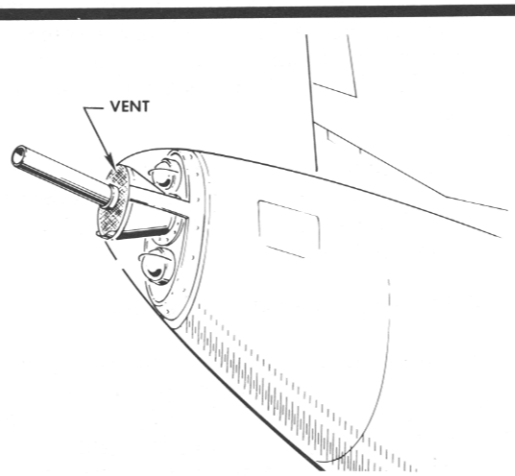
4 Depress ***PRI TEST*** button. Fueling should stop (hose will stiffen).

5 Depress ***SEC TEST*** button. Fueling will stop (hose will stiffen).

6 Depress ***AUX FILL*** and ***SHUTOFF AUX*** buttons together. Release ***AUX FILL*** button first; ***SHUTOFF AUX*** button should remain in depressed position. Full servicing should be completed in approximately 12 minutes.



7 Fuel may come out of wing tip vents. If this occurs, turn off refueler momentarily. Valves will reseat.

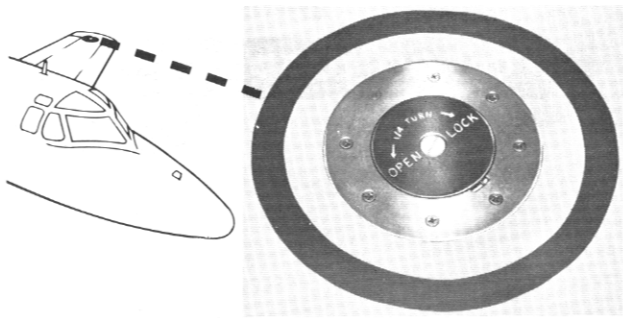


39A-1-48-6B

Figure 4-16

tank refueling valve, and fuel pressure, venting, and sensing lines. During single-point refueling, fuel flows from the receptacle to the remote-control shutoff valve from where the fuel is discharged into each wing tank. As each wing tank becomes full, the level control and vent valve senses the full condition and signals (through fuel pressure sensing lines) the remote-control shutoff valve to close. To prevent inadvertent filling of the fuselage tank during single-point refueling, the fuselage tank dual level control valve closes when refueling pressure is applied to the system. The fuselage tank dual level control valve opens to allow fuel to enter the fuselage tank only after the fuselage tank refueling control buttons are pressed. In single-point refueling of the fuselage tank, fuel is routed from the single-point refueling receptacle to the dual level control valve within the fuselage tank. When fuel to the fuselage tank rises to full height, the valve floats act to shut off fuel flow. If single-point pressure refueling equipment is not available, the airplane can be filled with conventional refueling equipment through the gravity-fill access to each tank. The single-point refueling system is shown in figure 4-15.

LH WING FUEL FILLER RECEPTACLE (TYPICAL EACH WING)



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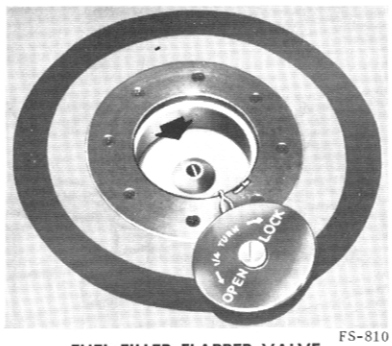


FS-810

FUEL FILLER FLAPPER VALVE (TYPICAL EACH WING)

T-39A-1-48-7

SINGLE-POINT REFUELING TEST AND FUSELAGE TANK REFUELING CONTROL BUTTONS.

The single-point refueling test and fuselage tank refueling control buttons (figures 4-16 and 1-31) are flush-mounted in the surface of the right wing leading edge adjacent to the single-point refueling receptacle. Two buttons, labeled "PRI TEST" and "SEC TEST," govern primary and secondary refueling valve test procedures for all tanks. Satisfactory valve operation is indicated by the shutoff of fuel flow, accompanied by the stopping of vibration and the stiffening of the refueling hose. A more positive indication of fuel shutoff can be obtained by observing the counter on the ground refueling equipment. An "AUX FILL" button controls fuel flow to the fuselage tank. A "SHUTOFF AUX" button locks and holds the "AUX FILL" button during fuselage tank refueling. Refer to "T-39A and T-39B Fuel and Environmental Systems," T. O. 1T-39A-2-2, for complete procedures and precautions on single-point refueling.

GRAVITY REFUELING.

Gravity refueling of the airplane is possible by filling through the fuselage tank filler while manually holding open the spring-loaded fuel filler flapper in the filler neck on each wing tip. The flappers must be released just before the fuel overflows from the opening. Then continue filling the fuselage tank until full. By using this method of refueling, it will take a minimum of 30 minutes to refuel the airplane.

Caution Observe all refueling precautions, as some fuel may be spilled before the fuel filler flappers are released.

NOTE Total usable fuel after gravity refueling will be about 8 gallons (52 pounds) less than pressure refueling total.

MISCELLANEOUS EQUIPMENT.

WINDSHIELD WIPERS.

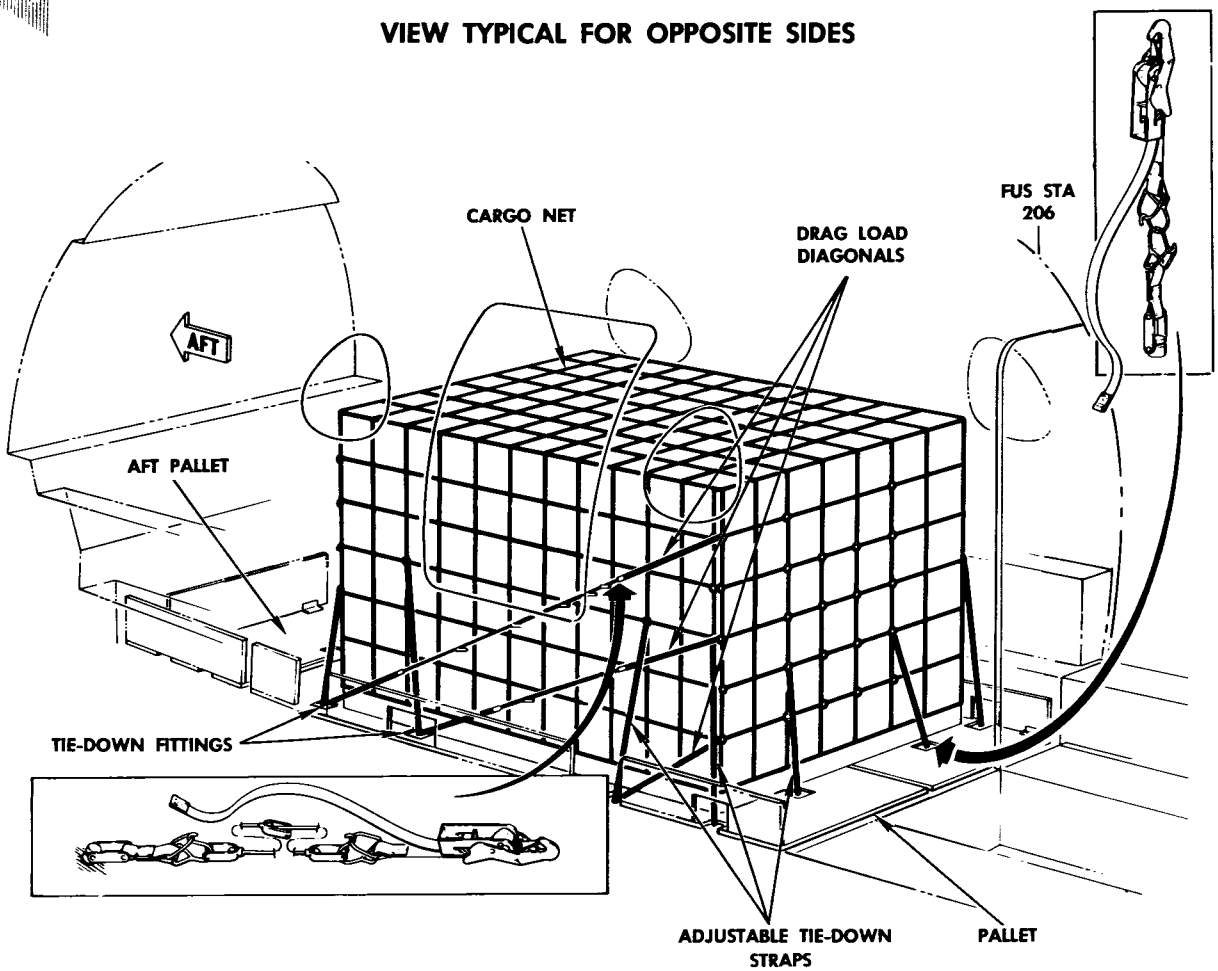
Electrically operated windshield wipers keep the exterior of the windshield panels in front of the pilot and copilot clear during adverse weather conditions. The multispeed wipers are controlled by a switch in the cockpit. The windshield wipers are designed to be used for ground operations and at airspeeds below 180 knots IAS.

Windshield Wiper Knob.

The five-position windshield wiper knob (11, figure 1-6), on the overhead control panel, is powered by the dc essential bus and has PARK, OFF, HIGH, MEDIUM (labeled "MED"), and LOW positions. Turning the knob to PARK powers the wipers to a stowed position. The HIGH, MEDIUM, and LOW positions are used to select the desired

CARGO LOADING

VIEW TYPICAL FOR OPPOSITE SIDES



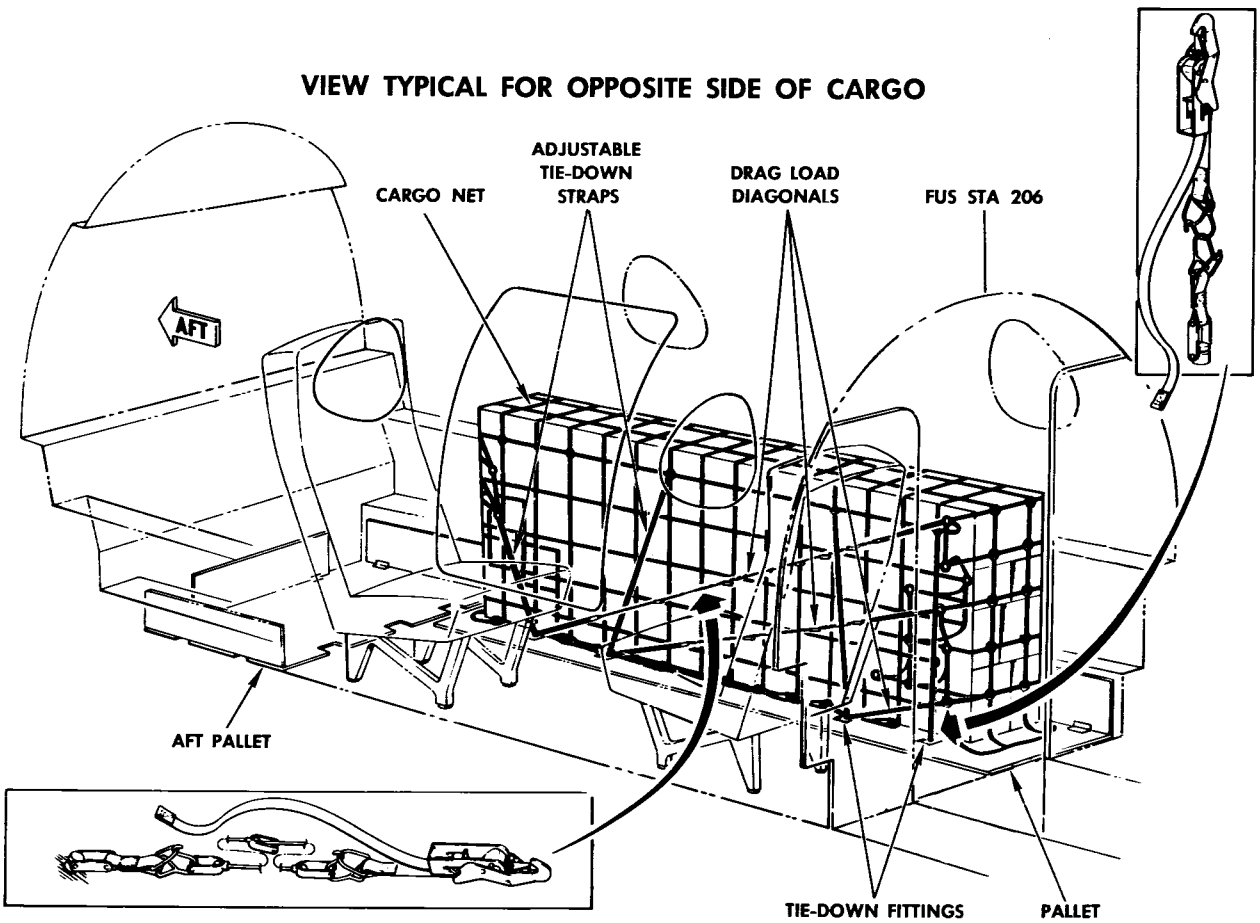
INSTRUCTIONS FOR CARGO LOADING

1. Remove passenger seats. If desired, remove right-hand bulkhead (station 206), baggage shelf, and right-hand fence (stations 147 to 206).
2. Install floor pallets and attach tie-down fittings to seat studs.
3. Load cargo according to the following instructions:
   - A. Maximum cargo weight: 1320 pounds, including baggage up to a maximum of 420 pounds.
   - B. Maximum cargo envelope, as illustrated: length 5 feet 5 inches, width 3 feet 5 inches, height 3 feet 3 inches.
   - C. Maximum floor loading: 130 pounds per square foot in cargo area.
4. Tie-down instructions:
   - A. Install cargo net over cargo, with net centered over cargo. Minimum cargo unit size is 6 x 6 inches.*
   - B. Attach adjustable tie-down straps to net and tie-down fittings as shown. Pull net taut.
   - C. Attach four drag load cables to aft tie-down fittings. Secure to forward side of net, using adjustable tie-down straps.
   - D. Pull drag load cables taut, using adjustable straps. Adjustable strap length must be 15-1/2 inches minimum, 19 inches maximum. If strap length exceeds dimension limits, adjust drag cable to next nearest link.
5. For weight and balance instructions, refer to Weight and Balance Technical Manual, T.O. 1-1B-40.

*For cargo less than specified minimum unit size, place tarpaulin over cargo before installing cargo net. T-39A-1-53-8

Figure 4-17

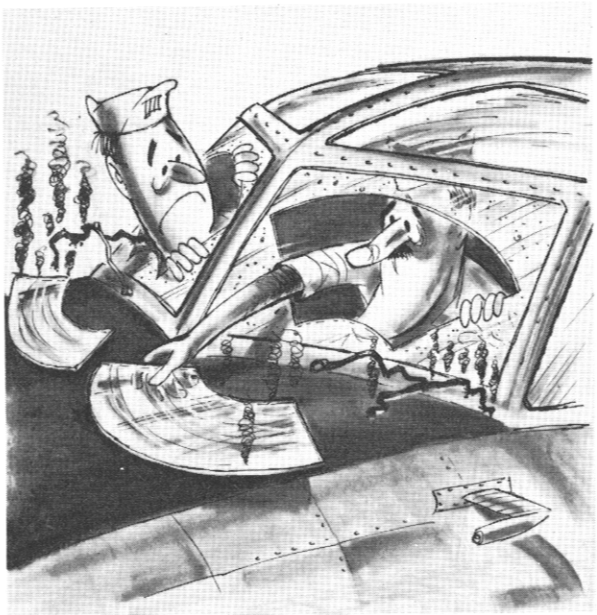
VIEW TYPICAL FOR OPPOSITE SIDE OF CARGO



INSTRUCTIONS FOR CARGO LOADING WITH TWO PASSENGERS

1. Remove both left passenger seats.
2. Install floor pallet and attach tie-down fittings to seat studs.
3. Load cargo according to the following instructions:
   A. Maximum cargo weight: 660 pounds.
   B. The weight of cargo, baggage, passengers, passenger seats, and passenger parachutes must not exceed a total of 1320 pounds.
   C. Maximum cargo envelope, as illustrated: length 7 feet 0 inches, width 0 feet 9 inches, height 3 feet 3 inches.
   D. Maximum floor loading: 130 pounds per square foot in cargo area.
4. Tie-down instructions:
   A. Install cargo net over cargo, with net centered over cargo.
   B. If cargo is not a single rigid unit, or a combination of units lashed together, install units in a suitable carton, or alternatively, install a vertical restraining panel full height of cargo and on inboard (aisle) side before installing cargo net. When a restraining panel is used in lieu of a large carton, the minimum cargo unit size is 6 x 6 inches unless cargo items are covered with a tarpaulin before the cargo net is installed.
   C. Attach adjustable tie-down straps to net and tie-down fittings as shown. Pull net taut.
   D. Attach four drag load cables to aft tie-down fittings. Secure to forward side of net, using adjustable tie-down straps. Diagonal locations shown are for a cargo height of 27 inches. For cargo height of 39 inches, locate diagonals at same heights as for 1320-pound cargo configuration.
   E. Pull drag load cables taut, using adjustable straps. Adjustable strap length must be 17 inches minimum, 24 inches maximum. If strap length exceeds dimension limits, adjust drag cable to next nearest link.
5. If a passenger is to be carried in the forward right-hand seat, the right-hand bulkhead (station 206), the baggage shelf, and the right-hand fence (stations 147 to 206) must be installed.
6. For weight and balance instructions, refer to Weight and Balance Technical Manual, T.O. 1-1B-40.

T-39A-1-53-9



CAUTION

Do not operate the wipers if the windshield is dry or dirty, as the windshield glass may be damaged.

T-39A-1-0-21

speed of the wipers. Turning the knob to OFF shuts off all power to the wiper motor.

Caution The windshield wiper low-speed position is not recommended for in-flight use. Do not operate continuously on low-speed position for longer than 5 to 10 minutes.

SIGNAL DATA RECORDER.†

Space provisions and wiring are provided for a signal data recorder. The recorder is installed to record airspeed total pressure, static pressure, and acceleration limits imposed on the airplane during flight. When the weight of the airplane is off the landing gear, the recorder is automatically energized and will operate until the airplane is landed. A two position signal data recorder override switch is on the pilot's instrument subpanel and is used for ground check-out only. When the switch is placed in the ON (forward) position, the recorder will operate on the ground. With the switch in the OFF (normal) position, the recorder will operate only during flight. The recorder is powered by the ac essential bus and the dc essential bus.

PASSENGERS' SEATS.

The four passengers' seats (figure 1-29) are upholstered and have an ash tray and padded armrest on the aisle side of the seat. Each seat is equipped with a pocket on the back, a safety belt, and a recess to fit a back-type parachute. The back cushion is easily removed to accommodate a back-pack parachute. If the parachute is not used, the recess can be filled with the back cushion that snaps in place. The two seats on each side of the cabin face each other. All four seats can be removed by releasing the locks on the inboard side of each leg.

Two-passenger/Baggage Seat.†

A combination, bench-type two-passenger/baggage seat (figure 1-29) with seat belts is installed in the aft end of the cabin. It has a center folding armrest containing an ash tray. The seat backs fold forward to permit access to the circuit-breaker panel, which is on the cabin rear bulkhead. The seat cushions are hinged at the front and can be folded up and forward to provide an additional baggage area for stowing luggage when one or both sides of the seat are not in use.

Crew-Chief/Passenger Seat.†

A crew-chief/passenger jump seat has been added in the area formerly used as the coat compartment, on the left side of the cabin just aft of the entrance. A seat belt and ash tray are provided for the crew-chief/passenger seat, and an oxygen mask is located above the seat. A chemical lavatory with an interconnecting relief tube is installed under the crew-chief/passenger seat. In addition, a waste-paper basket and a paper dispenser are mounted on the forward partition of the crew-chief/passenger seat.

WINDOW SHADES.

A concealed roller-type window shade is provided above each window in the passengers' compartment.

CURTAIN.

An accordion-style antiglare curtain closes off the cockpit from the cabin. On some airplanes,§ a curtain is provided for use between the partitions at the forward end of the cabin to isolate the lavatory area from the cabin.

BAGGAGE COMPARTMENT.

A forward baggage compartment (3, figure 1-1) is along the right forward side of the cabin, just aft of the cockpit and across from the main entrance door. Late airplanes§ also have an aft baggage area.

---

†AF59-2871 and all later airplanes
†Airplanes changed by T.O. 1T-39A-549
§AF62-4448 and all later airplanes

COAT COMPARTMENT.†

A coat compartment (6, figure 1-1) is just aft of the main entrance door on the left side of the cabin.

RELIEF FACILITIES.†

Relief containers are in the coat compartment. After use, the container is stowed in a receptacle on the floor of the baggage compartment.

† Airplanes not changed by T.O. 1T-39A-549

MOORING AND JACKING KIT.

The mooring and jacking kit is stowed in the baggage compartment.

PROTECTIVE COVERS.

Protective covers for the engine intake and exhaust and pitot heads are stowed in the baggage compartment when carried.

LIGHTNING PROTECTION.

Damage to the airplane by lightning is minimized

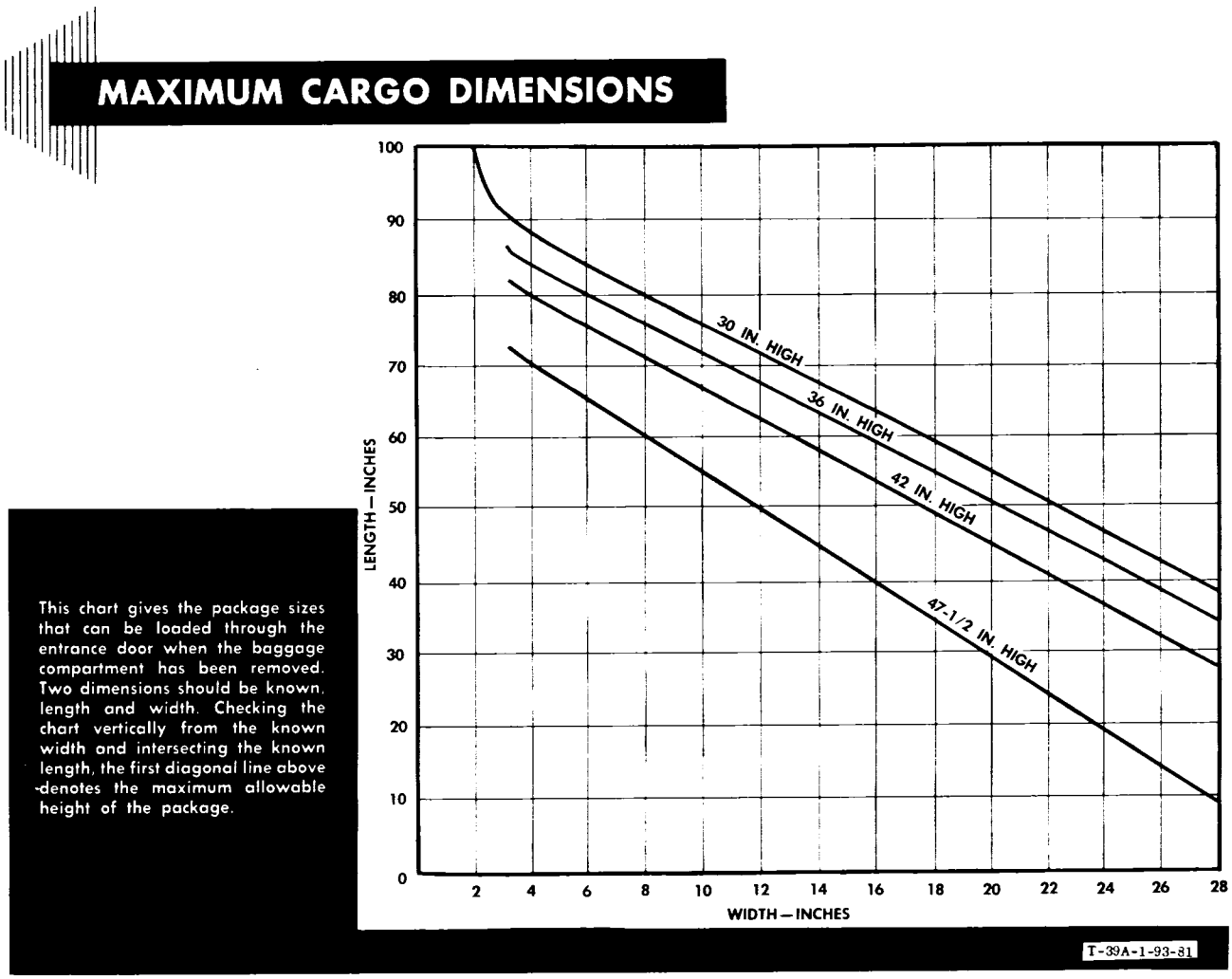


Figure 4-18

by the use of metal lightning protection strips mounted on the nose and wing tips. Two whip-type lightning arrester rods, one mounted above and one mounted below the fuel vent outlet, prevent damage to the fuel vent outlet flame suppressor.

FLIGHT REPORT AND MAP POCKETS.

A pocket on the back of both the pilot's and co-pilot's seats is used to stow the flight report and maps.

CARGO LOADING EQUIPMENT.

All equipment necessary to give this airplane a cargo-carrying capability and to safely secure the cargo is contained in a cargo tie-down kit. By removing the two passengers' seats on the left side or all four passengers' seats (depending on the cargo to be carried), the cabin compartment may be equipped to handle diversified types of cargo. Two typical loading configurations are shown in figure 4-17 and maximum cargo dimensions are given in figure 4-18. Normal loading of the airplane is accomplished through the main entrance door. For more detailed information, refer to Technical Manual, Cargo Loading and Unloading Instructions, T. O. 1T-39A-9. Also, refer to "Cargo Limitations" in Section V of this manual.

CARGO TIE-DOWN KIT.

The cargo tie-down kit consists of plywood pallets, tie-down fittings, tie-down straps, drag load cables, and a cargo net. Plywood pallets are used to provide more uniform weight distribution. Tie-down fittings attach to the existing seat studs through cutouts in these pallets. Cargo may then be secured by use of the cargo net, with adjustable tie-down straps and drag load cables providing vertical and lateral retention.

NOTE When cargo is installed, check to ensure that the in-flight and ground escape hatches are not blocked and a route is clear to the ground escape hatch.

OPERATING LIMITATIONS

SECTION V

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MINIMUM CREW REQUIREMENTS.

The minimum crew required for this airplane is a pilot and a copilot. Additional crew members can be added at the discretion of the Commander.

INSTRUMENT MARKINGS.

Careful attention must be given to the instrument markings (figure 5-1), because the limitations shown on these instruments and noted in the captions are not necessarily repeated in the text of this or any other section.

ENGINE LIMITATIONS.

All normal engine limitations are shown in figure 5-1 and are based on JP-4 fuel. However, all engine limitations in this section are applicable to alternate or emergency fuels. Special precautions must be observed when either the alternate or the emergency fuel is used.

THRUST DEFINITIONS AND TIME LIMITS.

Military Thrust.

Military Thrust is defined as the maximum thrust which may be used, and is time-limited to 30 minutes continuous operation. Military Thrust is selected by adjusting the throttle to obtain a specific exhaust total pressure, which will vary with altitude, air temperature, and Mach number. The chart for determining Military Thrust for take-off is contained in Part 2 of Appendix I. The chart for determining Military Thrust in flight is contained in Part 3 of Appendix I. Thrust computations may also be made using the J-201 computer. (Refer to Part 7 of Appendix I.)

Normal Rated Thrust.

Normal Rated Thrust is defined as the maximum thrust which may be used continuously. Normal Rated Thrust is selected by adjusting the throttle to obtain a specific exhaust total pressure, which will vary with altitude, air temperature, and Mach number. The chart for determining Normal Rated Thrust is contained in Part 3 of Appendix I. Thrust computations may also be made using the J-201 computer. Refer to Part 7 of Appendix I.

ENGINE OVERSPEED.

The maximum allowable engine speed is 104.2% rpm. If this speed is exceeded by either engine while the airplane is on the ground, the engines must be shut down. If this speed is exceeded in flight, use minimum thrust (on the engine which encountered the overspeed) to sustain flight and land as soon as possible.

NOTE The amount and duration of any engine overspeed must be entered in the Form 781, so that the prescribed engine inspection can be performed.

EXHAUST TEMPERATURE LIMITS.

Exhaust temperature limits are shown in figure 5-1.

NOTE The amount and duration of any engine overtemperature must be entered in the

INSTRUMENT MARKINGS

NOTE
Engine limitations are based on JP-4 fuel.

AIRSPEED INDICATOR (2)

	180 knots IAS	Maximum with gear and flaps extended
	.77 indicated Mach	Maximum allowable above 21,100 feet
	350 knots IAS	Maximum allowable from sea level to 21,100 feet

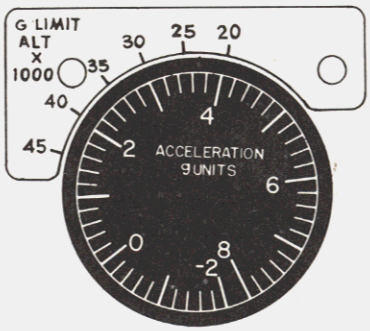
MACH METER

.77 indicated Mach
Maximum allowable above 21,100 feet

NEW

On airplanes changed by T.O. 1T-39A-549, the 20,000- and 25,000-foot altitude index lines are deleted from the placard.

ACCELEROMETER



NOTE
The scribed plate shows limit G as a function of altitude only for symmetrical flight and for fuel loading conditions where each fuel quantity gage indicates 2700 pounds or less. Refer to "Acceleration Limitations" in this section for additional limits.

OIL PRESSURE GAGE (2)

	35 psi	Minimum at idle rpm.
	40 to 50 psi	Normal

HORIZONTAL STABILIZER TRIM INDICATOR

6 to 9 degrees Caution

Do not exceed 180 knots IAS when horizontal stabilizer is trimmed in this area.

NOTE
This restriction is imposed because structural damage could occur at speeds above 180 knots IAS with the airplane trimmed in the 6- to 9-degree range.

39A-1-51-1H

Figure 5-1 (Sheet 1 of 3)

EXHAUST TEMPERATURE GAGE (2)

400°C to 565°C	Continuous
677°C	Maximum at Military Thrust (30 minutes continuous operation) and during engine acceleration.

NOTE

If exhaust temperature inadvertently drifts above 677°C during climb at Military Thrust, retard throttles as necessary to maintain exhaust temperature at or below 677°C.

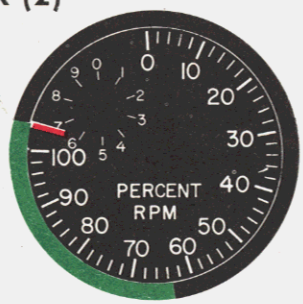
WARNING

- If exhaust temperature exceeds 720°C, shut down the engine.
- Exhaust temperature above 677°C constitutes overtemperature.

NOTE

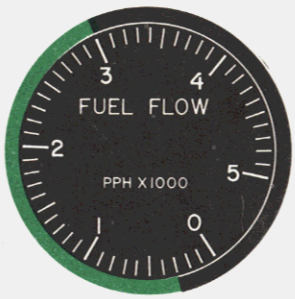
- During the starting cycle, exhaust temperature above 525°C requires shutdown to determine and correct cause of overtemperature.
- Maximum allowable stabilized exhaust temperature at idle rpm is 515°C.
- Maximum allowable exhaust temperature at Normal Rated Thrust is 565°C.

TACHOMETER (2)



63% to 104.2%	Normal operating range
104.2%	Maximum

FUEL FLOW INDICATOR (2)



300 to 3000 lb/hr	Continuous

NOTE

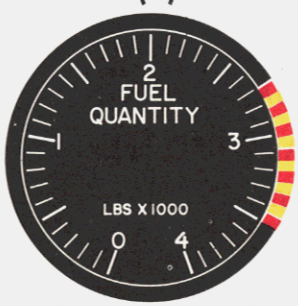
- Maximum during start is 600 pounds per hour.

FUEL QUANTITY GAGE (2)

NEW

Note

On airplanes changed by T.O. 1T-39A-549, the instrument markings (alternate red-yellow arc) have been removed.



2700 to 3500 LB

WARNING

Load factor limits reduced in this fuel quantity range. (Refer to "Acceleration Limitations" in this section.)

39A-1-51-2N

Figure 5-1 (Sheet 2 of 3)

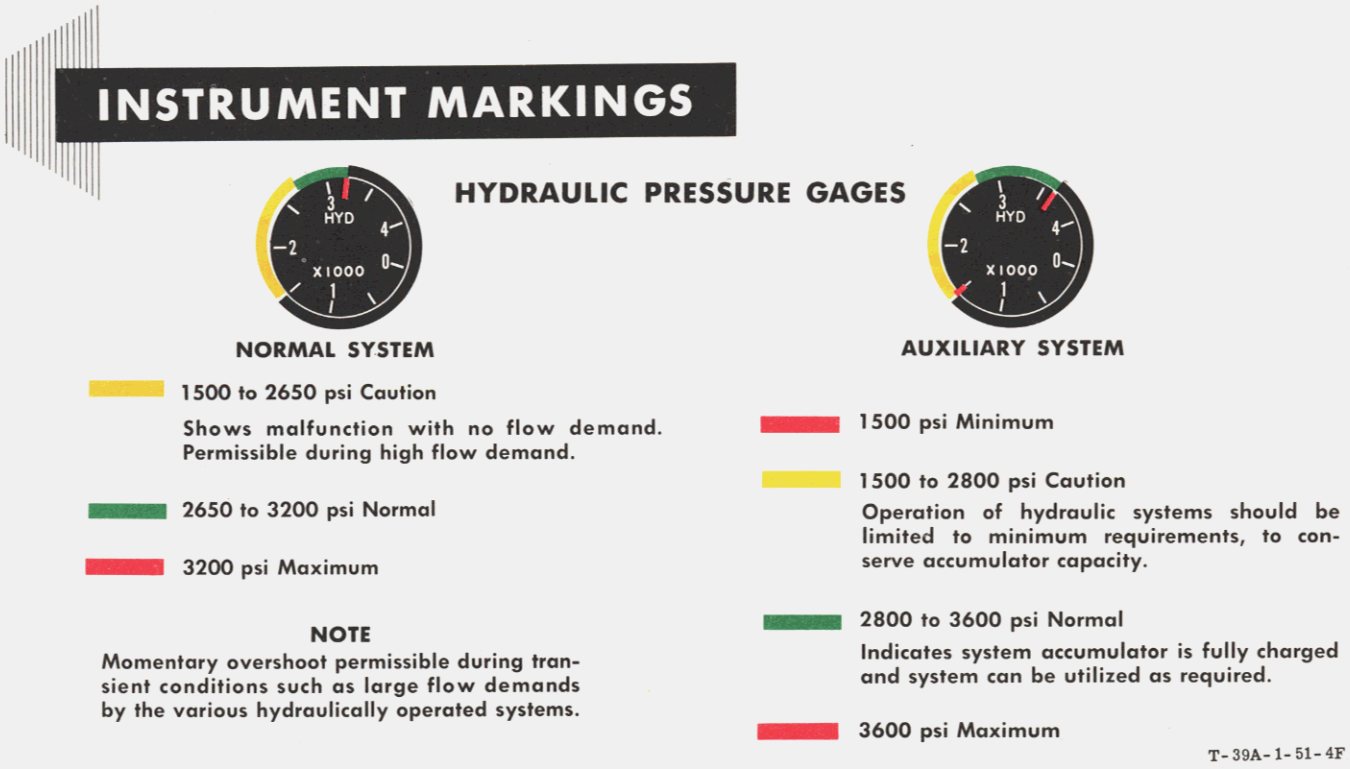


Figure 5-1 (Sheet 3 of 3)

Form 781, so that the prescribed engine inspection can be performed.

EXHAUST TOTAL PRESSURE LIMITS.

The chart for determining Military Thrust for take-off is contained in Part 2 of Appendix I. The charts for determining Military Thrust in flight and Normal Rated Thrust in flight are contained in Part 3 of Appendix I. Thrust computations may also be made using the J-201 computer. Refer to Part 7 of Appendix I.

OIL PRESSURE LIMITS.

Oil pressure limits are shown in figure 5-1. In addition, the following restrictions must be observed:

a. Oil pressure fluctuations of 5 psi within the normal operating range are permissible. During ground operation, if fluctuations occur and exceed 5 psi, the cause should be investigated before flight. During flight, if fluctuations occur and exceed 5 psi, reduce thrust on the affected engine and land as soon as possible.

b. If oil pressure is stable within the ranges of 35 to 40 psi or 50 to 60 psi during ground operation above engine idle rpm, the condition should be remedied before flight.

c. If oil pressure is steady or fluctuating within the 35 to 40 psi range during flight, remedial action is necessary. Refer to "Oil Pressure (35 to 40 PSI)" in Section III.

d. If oil pressure is above 50 psi during flight, remedial action is necessary. Refer to "Oil Pressure (Above 50 PSI)" in Section III.

ALTERNATE AND EMERGENCY FUEL LIMITATIONS.

ALTERNATE FUEL.

When an alternate fuel is used, flight is not to be conducted when the temperature is at or below the freeze point for the fuel being used. To ensure proper engine performance, operation at temperatures 10°F above the freeze point and colder is to be avoided. For the alternate fuels, the freeze point and recommended operating limits are as follows:

FUEL	FREEZE POINT	RECOMMENDED OPERATING LIMIT
JP-5	-55°F	-42.8°C (-45°F)
Type A	-40°F	-34.4°C (-30°F)
Type A-1	-58°F	-44.4°C (-48°F)
Type B	-60°F	-45.6°C (-50°F)

EMERGENCY FUEL (AVIATION GASOLINE).

Use of emergency fuel is permitted; however, successive flights on emergency fuel must be avoided. The engines should be retrimmed, if possible, for any flight with aviation gasoline. At high field altitudes and/or high temperatures, it may be difficult to obtain sufficient Pt5 for take-off without retrimming the engines.

AIRSPEED LIMITATIONS.

MAXIMUM ALLOWABLE AIRSPEED.

The maximum allowable airspeed is 350 knots IAS from sea level to 21,100 feet altitude and .77 indicated Mach number above 21,100 feet.

LANDING GEAR LOWERING SPEED.

The maximum allowable airspeed with the landing gear extended is 180 knots IAS. If the landing gear is extended above this speed, structural damage can occur.

WING FLAP LOWERING SPEED.

The maximum allowable airspeed with the wing flaps extended is 180 knots IAS. If this limit is exceeded, structural damage can occur.

HORIZONTAL STABILIZER TRIM SPEED LIMITATION.

When the airplane is trimmed within the range of 6 to 9 degrees airplane nose-up, do not exceed 180 knots IAS; otherwise, structural damage can occur.

AIRPLANE STALL AND HIGH-ALTITUDE FLIGHT LIMITATIONS.

Intentional power-on stalls are not recommended if the airplane is loaded near the aft CG limit.

In this airplane, engine flame-out may occur above 25,000 feet altitude under certain conditions of high angle of attack and low airspeed. The critical high angle of attack can be encountered at unaccelerated (1 G) stall. The flame-out is caused by turbulent airflow from the wing entering the engine inlet ducts.

Above 35,000 feet altitude, engine flame-out may be encountered at indicated airspeeds below 180 knots IAS, because of fuel control engine operational chracteristics. In addition, above 35,000 feet, rapid throttle movements at any airspeed may cause engine flame-out.

In view of the preceding, the following restrictions must be observed:

a. Above 25,000 feet altitude, do not perform stalls.

b. Above 35,000 feet altitude, maintain at least 180 knots IAS; do not make rapid throttle movements; and adjust one throttle at a time, to preclude the possibility of simultaneous flame-out of both engines.

MANEUVERING LIMITATIONS.

PROHIBITED MANEUVERS.

The airplane is restricted from performing the following maneuvers:

a. Spins. (Refer to "Spins and Spin Recovery" in Section VI.)

b. Aerobatics.

c. Yawing maneuvers in other than 1 G flight.

d. More than one-half aileron deflection

NOTE Full aileron deflections are permitted below the landing gear limit speed during take-off and landing.

e. Rolls. However, bank-angle changes up to 140 degrees are permissible.

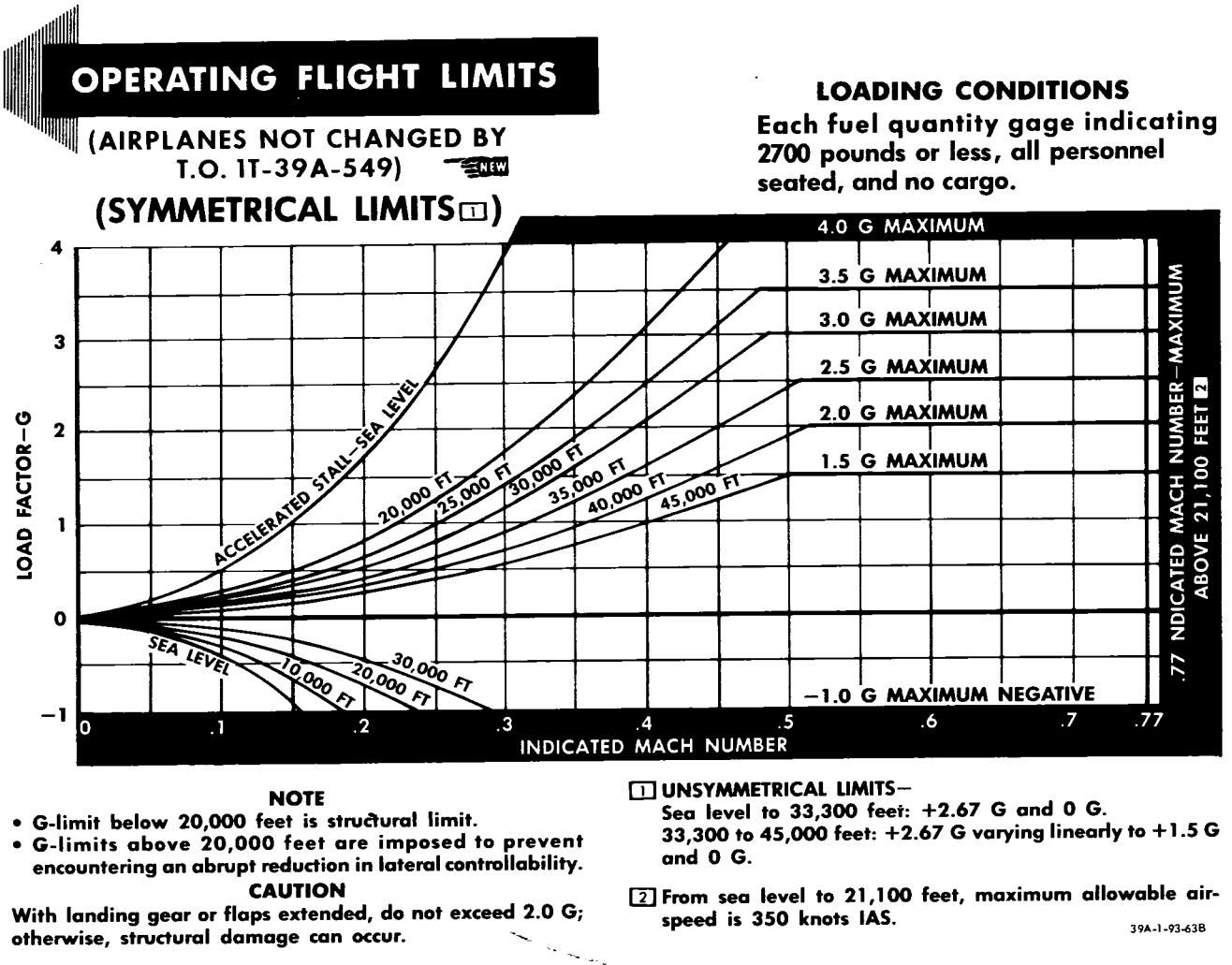
ACCELERATION LIMITATIONS.

The primary factors affecting acceleration limitations are the condition of fuel in the aft fuselage and wing tanks and the flight altitude. To ensure correct interpretation of the acceleration limitations imposed on this airplane, the following definitions apply:

a. Symmetrical applies where the airplane bank angle is constant (no roll). Therefore, the airplane may be in other than a wings-level attitude but must not be rolling during the period of accelerated flight.

b. Unsymmetrical applies where the airplane is rolling during the period of accelerated flight.

Acceleration limitations are imposed on this airplane for either structural or aerodynamic reasons. The structural limitations apply at all altitudes but may be less restrictive than the aerodynamic limits. The operating flight limits diagrams (figures 5-2, 5-3, and 5-4) show the symmetrical maneuvering envelopes for two loading conditions. The altitudes



NOTE

- G-limit below 20,000 feet is structural limit.
- G-limits above 20,000 feet are imposed to prevent encountering an abrupt reduction in lateral controllability.

CAUTION

With landing gear or flaps extended, do not exceed 2.0 G; otherwise, structural damage can occur.

1 UNSYMMETRICAL LIMITS—
Sea level to 33,300 feet: +2.67 G and 0 G.
33,300 to 45,000 feet: +2.67 G varying linearly to +1.5 G and 0 G.

2 From sea level to 21,100 feet, maximum allowable airspeed is 350 knots IAS.

39A-1-93-63B

Figure 5-2

at which aerodynamic limits prevail are noted on the diagrams. The aerodynamic limits are imposed to prevent encountering flight conditions where a sudden upfloat of the ailerons will occur, resulting in an abrupt change in lateral controllability. The composite structural-aerodynamic symmetrical limits are presented on a scribed plate along the upper edge of the accelerometer. (See figure 5-1.)

ZERO- AND NEGATIVE-G FLIGHT TIME LIMIT.

The airplane is limited to 10 seconds of continuous flight at zero and negative G, because of fuel oil and hydraulic system limitations. If this time limit is exceeded, engine flame-out may occur, the engines may be damaged because of oil starvation, or hydraulic pump failure may occur.

BAGGAGE LIMITATIONS.

On late airplanes† and modified airplanes,‡ baggage must be stowed in such a manner that will ensure compliance with the weight and balance operational limits contained in the Weight and Balance Technical Manual, T.O. 1-1B-40.

Baggage limitations must be observed as given in the following paragraphs.

FORWARD BAGGAGE AREA.

On some airplanes,§ the maximum total weight of baggage which may be carried is 250 pounds. Within this maximum weight, the maximum allowed on the baggage area shelf is 180 pounds; the maximum permitted below the shelf is 130 pounds.

a. On airplanes changed by T.O. 1T-39A-534 or -544 (installation of VHF-101 and AN/ARN-59

† AF62-4448 and all later airplanes
‡ Airplanes changed by T.O. 1T-39A-549
§ Airplanes not changed by T.O. 1T-39A-549

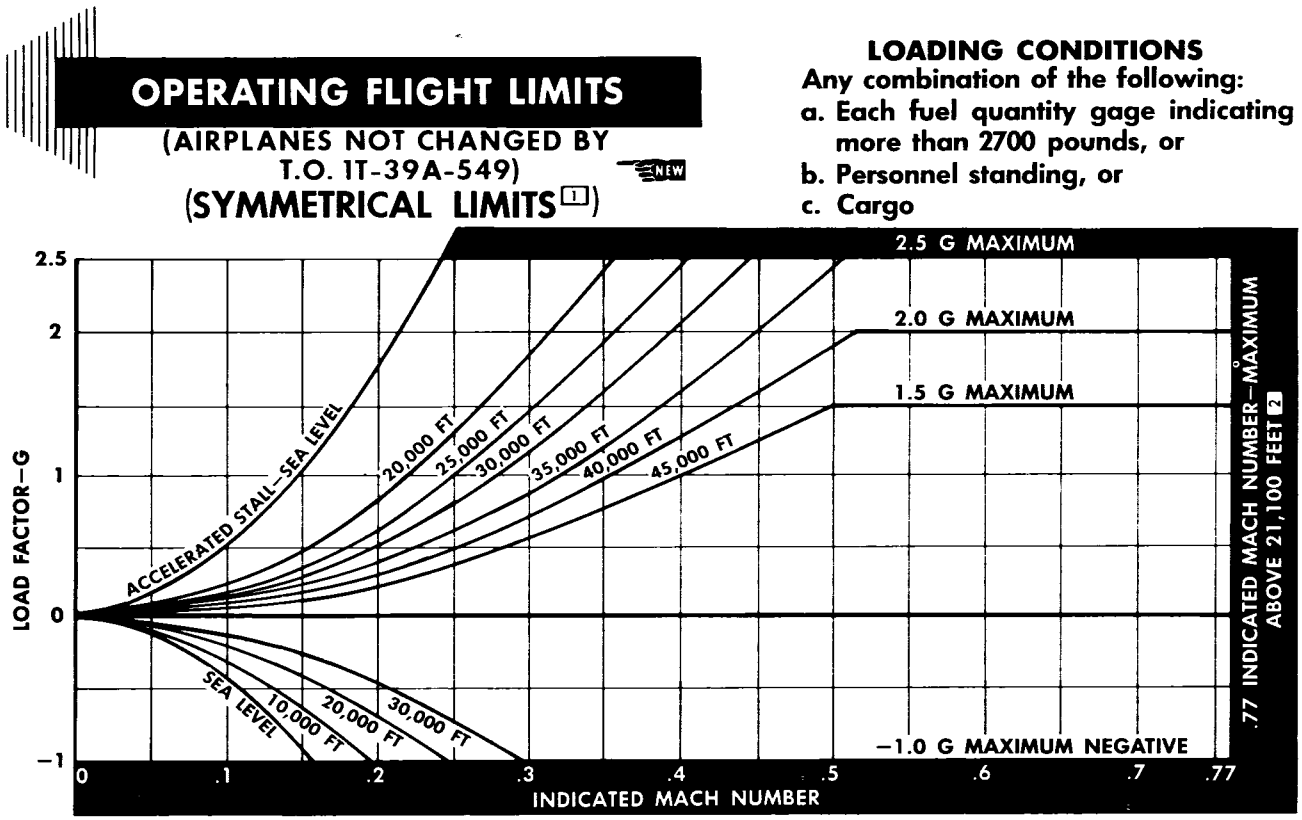


Figure 5-3

equipment), the maximum total baggage weight is reduced by 25 pounds.

b. On airplanes changed by T.O. 1T-39A-547 (installation of VHF radio), the maximum total baggage weight is reduced by 25 pounds.

On some airplanes,† the maximum total weight of baggage which may be carried is 270 pounds. Within this maximum weight, the maximum allowed on the baggage area shelf is 180 pounds; the maximum permitted below the shelf is 130 pounds.

AFT BAGGAGE AREA.

Airplanes before AF62-4448 not changed by T.O. 1T-39A-549 do not have an aft baggage area. AF62-4448 and all later airplanes not changed by T.O. 1T-39A-549 have an aft baggage area, and the maximum total weight of baggage which may be carried in this area is 170 pounds.

Some airplanes† have a two-passenger/baggage seat in the aft end of the cabin. When used as a baggage area, the maximum total weight of baggage which may be carried in this area is 340 pounds. When half the area is used for baggage, the maximum total weight of baggage which may be carried is 170 pounds.

CARGO LIMITATIONS.

The following additional limitations must be observed when the airplane is converted to cargo carrying:

a. The maximum cargo weight must not exceed 1320 pounds, or a combination of 1320 pounds of cargo and baggage. No passenger seats are installed for the full cargo configuration.

† Airplanes changed by T.O. 1T-39A-549

OPERATING FLIGHT LIMITS

(AIRPLANES CHANGED BY T.O. 1T-39A-549)

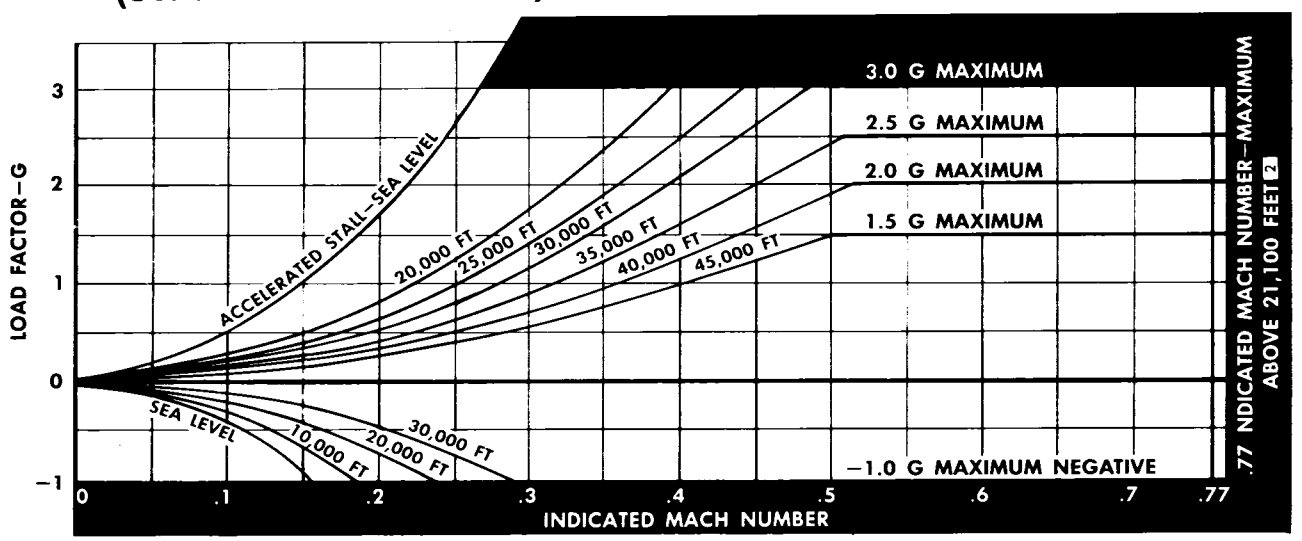
(SYMMETRICAL LIMITS[1])

LOADING CONDITIONS

Any fuel loading and all personnel seated.

NOTE

With any personnel standing, maximum allowable positive symmetrical limit is 2.5 G.



NOTE

- G-limit below 30,000 feet is structural limit.
- G-limits above 30,000 feet are imposed to prevent encountering an abrupt reduction in lateral controllability.

CAUTION

With landing gear or flaps extended, do not exceed 2.0 G; otherwise, structural damage can occur.

[1] UNSYMMETRICAL LIMITS—
Sea level to 33,300 feet: +2.0 G and 0 G.
33,300 to 45,000 feet: +2.0 G varying linearly to +1.5 G and 0 G.

[2] From sea level to 21,100 feet, maximum allowable airspeed is 350 knots IAS.

39A-1-93-90A

Figure 5-4

b. With two passengers' seats installed on the right side of the cabin, a maximum of 660 pounds may be carried on the left side of the cabin. However, the weight of cargo, baggage, passengers, passengers' seats, and passengers' parachutes must not exceed a total of 1320 pounds.

c. Acceleration limitations which must be observed when cargo is carried are presented in figure 5-3.

d. Maximum floor loading must not exceed 130 pounds per square foot in the cargo area.

CENTER-OF-GRAVITY LIMITATIONS.

The following paragraphs outline specific limitations which must be observed in order to maintain the airplane center of gravity within limits.

a. The center of gravity must be maintained in compliance with the weight and balance operating limits contained in the Weight and Balance Technical Manual. T.O. 1-1B-40.

b. If the gross weight (engines unstarted) center of gravity is aft of 31.3 percent MAC, both crew seats must remain occupied until the aft fuselage fuel tank contains less than 300 pounds of fuel.

c. During take-off, landing, and all prolonged climbs and descents, all personnel must be seated and both the pilot's and copilot's seat must be occupied. For all other flight conditions, only one person at a time is permitted to stand in the cockpit/baggage compartment area or between the rear seats (when the rear seats are occupied).

d. Personnel are not permitted in the area aft of the rear passenger's seats.

e. All occupants must be seated during all maneuvers with load factors in excess of 2.5 G.

f. Baggage and/or cargo must be stowed in such a manner that will ensure compliance with the weight and balance operational limits contained in the Weight and Balance Technical Manual, T.O. 1-1B-40.

PARACHUTE STOWAGE LIMITATIONS.

Parachutes for all personnel must be in the seats or stowed as close as practical to the user. Parachutes for the passengers and the spare parachute (when required) may be stowed on the floor of the forward baggage area or secured in an empty seat. On some airplanes,† parachutes for the passengers and the spare parachute (when required) may be stowed on the floor behind the two rear seats.

NOTE When parachutes are stowed in the baggage area, or in any other area, they must be considered as baggage weight.

WEIGHT LIMITATIONS.

The maximum allowable gross weight for this airplane is 17.760 (18,650†) pounds. It is the responsibility of the pilot to determine that this weight is not exceeded. Five factors will affect the airplane's actual gross weight (before engine start). They are:

a. The basic weight of the airplane, which is given in T.O. 1-1B-40 for the individual airplane.

b. Weight of personnel to be carried (standard weight of 190 pounds per person includes clothing, personal equipment, and parachute).

c. Weight of fuel to be carried.

d. Weight of baggage to be carried.

e. Weight of cargo to be carried.

Caution Because of structural limitations, the only items which may be carried in the coat compartment, except for the emergency ax, first-aid kit, oxygen demonstration mask, and oxygen walk-around bottle, are items which can be hung on coat hangers. These items will be hung on the hangers and not stowed on the compartment floor.

No two airplanes have the same basic weight, and the number of personnel and weight of baggage to be carried and the amount of fuel required may vary with the mission. Consequently, it would be possible to load an airplane in excess of 17.760 pounds. This would occur if the airplane's basic weight were at or near the design maximum and if six persons and full wing and fuselage tank fuel were to be carried. Thus, if the desired loading condition will result in the airplane's gross weight exceeding 17,760 pounds, the fuselage fuel tank must not be serviced beyond the amount which would cause the airplane gross weight to exceed 17,760 pounds. As long as this maximum allowable gross weight and the limitations given under "Center-of-Gravity Limitations" in this section are observed, there is no other weight limitation applicable to this airplane. On some airplanes,† the maximum allowable gross weight is 18,650 pounds, and with full fuel, baggage, and with a crew of two and seven passengers, the airplane weight should not exceed this figure.

† Airplanes not changed by T.O. 1T-39A-549
† Airplanes changed by T.O. 1T-39A-549

FLIGHT CHARACTERISTICS

SECTION VI

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GENERAL FLIGHT CHARACTERISTICS.

Light to moderate control force is adequate for maneuvering the airplane throughout the designed speed and altitude range. Stability and general flight characteristics are good within the operating limits of the airplane.

STALLS.

The stall characteristics of the airplane are safe, and there is a well-defined stall indication. Some light to moderate airframe buffet is noticeable during the approach to the stall, but does not increase appreciably at the stall. A mild rolling tendency usually will be observed at stall, and possibly some stick force lightening. Light wing flap buffet is also present with the flaps extended, but becomes negligible above the stall.

The airplane can be controlled below the stall to a minimum speed, which in most conditions is limited by available longitudinal control.

The airplane will be elevator-limited at stall with forward center of gravity, landing gear and flaps extended, and idle thrust. The full stall cannot be obtained in this configuration, and the airplane will oscillate mildly in pitch if full elevator is maintained. The oscillation stops as soon as back pressure on the longitudinal control is released. Stall speeds for varying bank angles, gear and flaps up or down, power off, and power on are shown in figure 6-1.

NOTE Thrust settings used during power on stalls approximate that power required to maintain a speed of 1.6 above the power-off stall speed (1.6 V_S) for a level-flight cruise condition. This speed approximates the normal downwind pattern speed as shown in figure 2-6.

ACCELERATED STALLS.

Accelerated stall characteristics are essentially like those for unaccelerated stalls. However, buffet warning begins considerably above stall speed, but does not increase significantly until just before stall.

STALL RECOVERY.

Stall recovery is most easily accomplished by lowering the nose of the airplane and increasing engine thrust symmetrically as necessary to build up airspeed.

NOTE If stall occurs during single-engine operation, increase thrust cautiously, to minimize yawing and rolling tendencies associated with stall.

ENGINE FLAME-OUT.

The engine compressor is sensitive to airflow disturbances from the wing during either the 1 G or accelerated stall at altitudes above 25,000 feet. This can result in engine compressor stall and subsequent engine flame-out if the condition is permitted to progress. (Refer to "Airplane Stall and High-altitude Flight Limitations" in Section V.)

SPINS AND SPIN RECOVERY.

A spin test program is not required for this airplane. However, wind tunnel tests and analytical studies indicate a normal spin recovery is the optimum procedure for recovering from a spin. If a spin is inadvertently entered, proceed as follows:

WARNING

Intentional spins in this airplane are prohibited.

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1. Apply recovery controls, full rudder against the spin, control wheel and control column neutral, and trim airplane nose down.

2. Move throttles to IDLE.

3. When rotation stops, neutralize controls and recover from the stalled condition.

Warning Do not hold recovery controls after rotation stops; otherwise, the airplane may enter a spin in the opposite direction.

Caution If landing gear or flaps are extended, do not exceed gear and flap limit speed during recovery; otherwise, excessive air loads may cause structural damage.

FLIGHT CONTROL EFFECTIVENESS.

HORIZONTAL STABILIZER AND ELEVATORS.

Elevator control friction is very low, resulting in light elevator breakout force. Stick forces can become very light in cruise and power approach configurations at aft CG's.

Extended periods of flight (15 minutes or more), with an abnormal nose-high attitude (exceeding 8-1/2 degrees), with one-half to three-quarters wing fuel will cause the fuel to shift outboard and aft in the wing tanks. This fuel shift will cause the airplane CG to move slightly aft, resulting in a light to moderate trim and force change in the elevator control. (Refer to "Fuel Availability During Flight" in Section VII.)

Elevator trim changes induced by changes in engine thrust are easily controllable and forces are light. Trim changes due to raising the flaps are moderate. Trim changes while raising the landing gear are negligible. When the airplane is trimmed to a landing configuration with the gear and flaps down, a large trim change will occur as the throttles are advanced to Military Thrust and the gear and flaps are raised. Stick forces will become high to overcome the trim change. Engine thrust and configuration changes should not be made simultaneously, and the airplane should be trimmed continuously throughout such changes to keep the elevator control forces low.

The elevators provide excellent pitch control throughout the speed and altitude range of the airplane.

Horizontal Stabilizer Trim.

The horizontal stabilizer trim system is adequate throughout the speed and altitude range of the airplane. However, it is possible to stall the stabilizer trim motors if an attempt is made to trim out a push force in excess of approximately 50 pounds at high airspeeds. Reducing airspeed or reducing the push force while actuating trim will eliminate the stalled condition of the trim motors.

AILERONS.

The ailerons will provide adequate control in cruise and high-speed flight. Aileron control is also adequate in the approach and landing configurations. The ailerons are effective in steering the airplane on the ground at speeds down to about 50 knots

STALL SPEEDS—KNOTS IAS

DATA AS OF: 6 NOVEMBER 1962
BASED ON: NAA FLIGHT TEST DATA

POWER OFF (IDLE)

GROSS WEIGHT—POUNDS	FLAPS UP				FLAPS 66% DOWN				FLAPS 100% DOWN			
ANGLE OF BANK—DEG	0	30	45	60	0	30	45	60	0	30	45	60
LOAD FACTOR—G	1.0	1.2	1.4	2.0	1.0	1.2	1.4	2.0	1.0	1.2	1.4	2.0
10,000	79	85	94	112	76	81	90	107	74	79	87	104
12,000	87	93	103	123	83	89	99	117	81	87	96	114
14,000	94	101	111	132	89	96	106	126	87	94	104	123
16,000	100	108	119	141	96	103	114	135	93	100	111	132
18,000	106	114	126	150	101	109	121	143	99	106	117	140

POWER ON

(Thrust required to maintain 1.6 V_S in a cruise flight condition. See applicable text.)

GROSS WEIGHT—POUNDS	FLAPS UP				FLAPS 66% DOWN				FLAPS 100% DOWN			
ANGLE OF BANK—DEG	0	30	45	60	0	30	45	60	0	30	45	60
LOAD FACTOR—G	1.0	1.2	1.4	2.0	1.0	1.2	1.4	2.0	1.0	1.2	1.4	2.0
10,000	74	80	88	105	72	77	85	101	70	75	83	99
12,000	81	87	97	115	79	84	93	111	76	82	91	108
14,000	88	95	105	124	85	91	101	120	83	89	98	117
16,000	94	101	112	133	91	97	108	128	88	95	105	125
18,000	100	107	118	141	96	103	114	136	94	101	111	132

NOTE

Landing gear position does not affect stall speeds.

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Figure 6-1

IAS. The landing gear geometry is such that the change in lift between the wing panels when aileron is applied will cause the airplane to tilt and turn toward the down wing (application of left aileron will cause the right wing to rise, depressing the left main gear strut and causing the airplane to tend to turn left). At speeds above about 50 knots IAS during take-off run or landing roll, the ailerons should be used to augment directional control, rather than asymmetric braking or asymmetric application of thrust.

Aileron Trim.

The aileron trim is adequate for all normal flight conditions. Any allowable asymmetric fuel condition which develops between the wing fuel tanks can be trimmed out. (Refer to "Fuel System Management" in Section VII for information on allowable asymmetric fuel conditions.)

RUDDER.

The rudder effectiveness is adequate under all flight conditions, including single-engine operation. Dihedral effect (roll due to yaw) is positive. Consequently, the rudder is most effective in picking up a low wing at low airspeeds. A steady heading can be maintained into a stall.

Rudder Trim.

There is sufficient rudder trim available to trim out all yaw at all speeds during two-engine operation. At recommended cruise speed during single-engine operation, the mild yaw due to asymmetric thrust can be trimmed out easily. However, at low airspeeds during single-engine operation, a 5-degree bank into the good engine will facilitate directional control.

FLAPS.

The wing flaps provide reduced approach and landing speeds. Light buffet will be encountered when the flaps are lowered full down.

SPEED BRAKE.

The speed brake can be fully extended at any airspeed and is very effective as a drag device. No buffet will occur when the speed brake is extended (gear and flaps up). A slight nose-down trim change occurs, and cockpit and cabin noise increases noticeably when the speed brake is extended.

SLATS.

The wing leading edge slats improve airplane stability at high angles of attack, decrease airplane drag in maneuvering flight, and delay the onset of buffet. They are designed to operate at both low and high Mach numbers. Slat operation is automatic and depends on the airspeed and angle of attack. The slats normally are open at low airspeeds and closed at recommended climb and cruise speeds.

LEVEL-FLIGHT CHARACTERISTICS.

LOW SPEED.

Recommended speeds for take-off, approach, and landing are given in the appropriate charts in Appendix I. At low speeds, flight characteristics are conventional, with normal control effectiveness and airplane response. (Refer to "Directional Stability Characteristics" in this section for additional information.)

NOTE During low-speed flight when power is changed from idle power to full power, such as in a go-around, there is a nose-up tendency. Trim should be started when power is applied to assist in maintaining desired attitude.

CRUISE SPEED.

Elevator and aileron control forces are light in the cruise speed region at high altitude, and very little pilot effort is required to effect a change in airplane attitude. Cruise conditions can be maintained quite easily.

DIRECTIONAL STABILITY CHARACTERISTICS.

The static directional stability of the airplane is positive for all airspeeds and configurations. However, yawing oscillations in gusty or turbulent air may be damped out by holding the rudder and ailerons neutral.

MANEUVERING FLIGHT.

Maneuvering flight elevator force increases with an increase of G forces when the center of gravity is forward. When the center of gravity is aft, there is less change in elevator force for a given change in G. Increasing altitude at constant Mach number will result in maneuvering forces becoming somewhat lighter.

DIVES.

During maximum-rate descents, stability and control characteristics are good. Control forces are at a comfortable level, and no adverse airplane characteristics prevail.

SYSTEMS OPERATION

SECTION VII

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AIR TEMPERATURE VS THRUST.

Air density, and therefore engine performance, of all air-breathing jet engines is affected by inlet air pressure and temperature. When inlet air density is increased by either a lower air temperature or a higher ram pressure, the engine, at a constant rpm, "pumps" an increased quantity of air (by weight), resulting in an increase in fuel flow and, subsequently, thrust.

HOT START.

Several factors can cause a hot start (EGT greater than 525°C), and the pilot should be able to recognize the early signs to enable him to take corrective action (retard throttle to CLOSED).

After initial ignition has been indicated by EGT rise, monitor the EGT, fuel flow, and rpm. A fuel flow of over 600 pounds during initial starting will result in an improper fuel-air ratio which will invariably cause a very rapid rise in EGT. Under this condition, the maximum allowable starting EGT will probably be exceeded if the throttle is not retarded by the time the EGT indicator reaches 475°C.

A hot start may result from engine rpm hanging up and failing to accelerate to idle rpm in a normal manner after ignition. The pilot should be alert to recognize a steady increase in rpm after ignition as well as stable temperature indications and anticipate preventive action for a hot start as soon as the engine rpm fails to increase in a smooth and constant manner.

OIL PRESSURE.

When oil pressure is normal, adequate oil flow for lubrication and for cooling is indicated. When oil pressure falls below, or fluctuates to below, 40 psi, oil flow may not be adequate for lubrication. In addition, cooling may be reduced, resulting in increased bearing temperatures. High bearing temperatures can lead to relatively rapid bearing failures. Thrust should be reduced when low oil pressures are noted. This reduction in thrust reduces bearing loads (particularly in thrust bearings), reduces internal friction in the bearings when rpm is reduced, and reduces heat transfer into the bearings from the engine. Bearing failure caused by oil starvation is generally characterized by a slight vibration which rapidly increases and very quickly results in an engine seizure.

COMPRESSOR INTERSTAGE AIR-BLEED SYSTEM.

Engine interstage air is bled overboard from the fourth stage of each engine, to preclude compressor instability at low engine thrust conditions. Operation of the compressor interstage air-bleed system is completely automatic. The interstage bleed valves are automatically opened or closed by the engine fuel control at engine speeds ranging from 79 to 81 percent rpm.

Caution (Eff 15-11, 26 JAN 67)

Engine speed fluctuations may occur in the 79 to 81 percent rpm range if the interstage bleed valve cycles. If the fluctuations do occur, advance or retard the throttles as necessary to obtain stable operation outside this range.

Because of a malfunction or failure, the bleed valve may not close as scheduled, resulting in the possibility of the valve remaining open at high thrust levels. Operating with the valve open for extended

periods at thrust levels where it is normally closed imposes undesirable stresses in the compressor section of the engine. It, therefore, is desirable to recognize this condition and reduce the throttle to the bleed-valve-open point (approximately 81 percent rpm).

An engine with a bleed valve stuck in the open position can be readily identified by comparing rpm, fuel flow, and EGT between engines at a constant P_{t5}. Because of the increased output of the engine with the malfunctioning valve, the rpm, fuel flow, and EGT will all read higher. At Military Rated Thrust, these differences become quite substantial with EGT approaching the operating limits, and precomputed P_{t5} may not be obtainable for take-off thrust settings.

FUEL SYSTEM MANAGEMENT.

FUEL BALANCING.

Before take-off, fuel unbalance between the wing tanks must not exceed 200 pounds. During flight, it is recommended that the fuel balancing procedure be used when the fuel unbalance exceeds 200 pounds. For balancing the fuel in the wing tanks, move the fuel cross-feed and tank selector switch to select the heavier tank. This will supply both engines with fuel from the heavy tank. When the fuel level is equal in both wing tanks, return the switch to NORMAL. If fuel balancing fails to occur after the fuel cross-feed and tank selector switch is positioned to the heavier tank, pull the lightweight wing tank boost pump circuit breaker.

FUEL AVAILABILITY DURING FLIGHT.

If the airplane is flown at a pitch angle in excess of about 8-1/2 degrees nose-up for a protracted period, fuel will be trapped in the outboard segment of each wing tank. Consequently, flame-out could occur under this flight condition, even though the fuel quantity gages showed a usable supply of fuel remaining in the tanks.

During low-altitude climbs, the airplane nose-up pitch attitude exceeds 8-1/2 degrees for only a short period of time, insufficient to induce the flame-out condition. This is because low-altitude climb cannot normally be entered without the airplane having been previously held in a level attitude (or nose-down attitude such as on the ground before take-off, in level flight, or in a descent), which would permit gravity flow of the fuel. For all other normal flight conditions, the airplane nose-up pitch attitude will be less than that which would result in trapping the fuel in the outboard segments of the wing tanks. (The normal flight condition which most nearly approaches the critical 8-1/2 degrees nose-up pitch attitude is loitering flight, and then, if recommended speeds are observed, the pitch attitude will not exceed about 6-1/2 degrees nose-up.)

OPERATION ON ALTERNATE OR EMERGENCY FUEL.

ALTERNATE FUEL.

JP-5 is the alternate fuel for this airplane. Alternate fuel is defined as fuel which may be substituted for the recommended fuel with possible restriction to airplane performance. Alternate fuel does not cause permanent damage to the engine or fuel systems; however, its use may require engine retrim.

Generally, the full P_{t5} take-off rating will be more readily available with the denser kerosene-type fuels, and airplane range performance will be at least as good as, or slightly better than, with JP-4 fuel.

Ground starts in cold weather and air starts at high altitude may be slower and more difficult because of the negligible fuel vapor pressure (0 psi) of JP-5.

EMERGENCY FUEL.

Aviation gasoline in the lowest grade available may be used as an emergency fuel for one-time flights. It will generally be necessary to retrim the engines when aviation gasoline (AVGAS) is to be used.

Caution Prolonged use of aviation gasoline causes leading of jet engines, and may eventually lead to overtemperatures and engine failure.

- Add 3 percent of Specification MIL-L-22851, Type II or Type III, Grade 1100, engine oil to the AVGAS.

NOTE Fuel quantity gages may read about one percent high on a Standard Day when the alternate fuel is used, and as much as 2 percent low when the emergency fuel is used.

Aviation gasoline has poor lubricating properties, and the engine oil is necessary to prevent failure of the fuel pumps.

WHEEL BRAKE OPERATION.

To reduce airplane accidents and maintenance problems caused by tire, wheel, and wheel brake failure, the following precautions must be observed when practical:

a. Check brakes; then use as little and as lightly as possible. Take full advantage of the length of the runway, using aerodynamic braking if practical.

b. To prevent skidding the tires, use extreme care when applying brakes immediately after touchdown, or any time there is considerable lift on the wings. Heavy brake pressure will lock the wheels more easily immediately after touchdown than when the same pressure is applied after the full weight of the airplane is on the tires. As long as brake pressure is maintained, a wheel once locked in this manner immediately after touchdown will not become unlocked as load increases. Brakes can stop the wheels from turning, but stopping the airplane depends on the frictional force between the tires and the runway. As the load on the tires increases, the frictional force increases, giving better braking action. During a skid, the friction force is reduced, thus requiring more distance to stop.

c. If optimum wheel braking is required, lift should be decreased as much as possible by lowering the nose gear to the runway before applying brakes. After brake application, pull the control wheel aft to increase weight on the main gear. This procedure improves braking action, since the load on the tires will increase the frictional force between the tires and the runway.

d. Optimum braking can be achieved by applying a continuously increasing force on the pedals as the airplane slows down, attempting to remain just short of skidding. This procedure is applicable when operating on the normal braking system.

e. When operating on the emergency braking system, pump the brakes up with the pedals; then use a smooth, steady application of brakes with constantly increasing pedal pressure as required. Do not release the pedals completely; otherwise, the pumping action will have to be repeated.

Caution When the emergency brake system is used, only one pilot is to operate and pump the brake pedals.

f. During a series of successive full-stop landings, a minimum of 15 minutes should elapse between landings if the landing gear remains in the slip stream, and a minimum of 30 minutes should elapse between landings if the gear is retracted, to allow adequate cooling time between brake applications. This time restriction is not applicable to touch-and-go landings if no brake application is involved.

g. The brakes should not be dragged while taxiing, and should be used as little as possible for turning the airplane on the ground.

h. At the first indication of brake malfunction, or if brakes are suspected to be overheated after excessive use, the airplane should be maneuvered off the active runway and stopped. The airplane should not be taxied into a crowded parking area. Overheated wheels and brakes must be cooled before the airplane is subsequently towed or taxied or before the parking brakes are set. Peak temperatures in the wheel and brake assembly are not attained until 5 to 15 minutes after a maximum braking operation is completed. In extreme cases, if proper cooling is not effected, heat build-up can cause the wheel blowout plugs to fail. Taxiing at low speeds to obtain air cooling of overheated brakes will not reduce temperatures adequately and can actually cause additional heat build-up.

BATTERY START.

This airplane is designed to be self-sufficient; successful battery starts can normally be expected, provided the batteries are in good condition. As with any start, the airplane should be parked into, or at right angles to, the wind. All checklist items not requiring electrical power should be accomplished before turning the electrical master switch ON to conserve battery power. The ac-powered engine instruments will not be available until after the electrical master switch has been placed at ON, energizing the stand-by inverter. Electrical loads not essential to start should be turned OFF during the start. Start either engine, using the following procedure:

Caution Main gear wheels must be chocked during battery starts, as hydraulic pressure for wheel brake operation is not available until the hydraulic pump switch is turned ON after both engines are operating.

1. Battery switch - ON.
2. DC generators - ON.
3. Inverter - STBY.
4. Radio and instrument master switch - ON.

NOTE If a low battery is suspected, the switch may be left off until engine start is indicated.

5. Electrical master switch - ON (dc voltmeter, minimum 21 volts).
6. Engine master switch - ON.
7. Engine starter button - Depressed momentarily. It may be necessary to hold starter button depressed.

Caution To prevent engine damage, if there is no tachometer indication of engine rotation or oil pressure within 20 seconds, pull out the starter button to stop the starting cycle.

- When it is elected to leave the radio and instrument master switch off, EGT and rpm will be the only indications available

during start. To obtain oil pressure reading and prevent engine damage, the switch must be turned ON within 20 seconds after the starter is engaged.

8. Throttle - IDLE at 8 to 10 percent rpm.

NOTE If the initial fuel flow is above 600 pounds per hour, terminate the start at once, as a hot start can be anticipated.

9. Monitor EGT and rpm very closely. The same limitations apply as for external power start. If rpm stabilizes below idle while EGT continues to increase, a hot start may be anticipated.

10. Check all engine instruments.

Operate the engine at 65 to 70 percent rpm while starting the second engine.

11. Complete checklist items not previously covered.

12. Start other engine. (Repeat steps 6 through 11.)

NOSE WHEEL STEERING OPERATION.

It is recommended that the airplane not be operated with a known failure of either the main or stand-by nose wheel steering system. The stand-by is not an alternate system, but is a reserve system which is automatically engaged when the main system becomes defective. Both of these systems function essentially the same. However, the stand-by system has several characteristics not found in the main system. In stand-by steering, the steering buttons on the control wheels are inoperative.

On some airplanes, † the only means of disengaging stand-by steering on the ground (after automatic transfer to stand-by steering) is by momentarily turning the electrical master switch off or by pulling the main and stand-by steering circuit breakers. After lift-off, stand-by steering is disengaged by placing the steering selector switch at STANDBY momentarily, then back to MAIN. After landing with all three gear on the ground, the stand-by nose wheel steering system may be engaged by placing the nose wheel steering selector switch at STANDBY.

Caution If it becomes necessary to completely disable both steering systems by pulling the two circuit breakers after an automatic transfer to stand-by steering, pull the main system circuit breaker first. If the stand-by circuit breaker is pulled first, steering will automatically transfer back to a failed main system.

- If automatic transfer to stand-by steering has occurred during takeoff, the nose wheel steering-on indicator lights, main steering system failure caution light, and master caution lights will remain on after lift-off. Do not retract the landing gear until the nose wheel steering-on indicator lights and main steering system failure light have been extinguished, indicating that the stand-by steering system is disconnected.

On some airplanes, ‡ the stand-by steering system may be disengaged on the ground by pressing and releasing either nose wheel steering button (disarms the main system to prevent another transfer cycle) and placing the steering selector switch to STANDBY momentarily, then back to MAIN. If automatic transfer to stand-by steering has occurred during take-off, it will automatically disengage after becoming airborne.

If an emergency condition warrants or if an operational necessity dictates that the airplane be operated with a known failed main or stand-by nose wheel steering system, the following information is provided as the least objectionable operating procedure available.

Caution When operating with a known failed system (main or stand-by), there is no backup system, and, in the case of operating on stand-by with a failed main system, a subsequent failure of the stand-by system will not result in a free-caster condition.

- With a known or suspected failure of the main or stand-by nose wheel steering system, steering should be limited to taxiing at a conservative speed.

OPERATION WITH A KNOWN FAILED MAIN SYSTEM.

Before operation with a known failed main system, pull the "NLG STEER - MAIN" circuit breaker (on left console) to isolate the failed system. The stand-by steering system can now be turned on by placing the nose wheel steering selector switch at STANDBY. Disengage steering by placing the selector switch at MAIN. The stand-by steering will be automatically disengaged at lift-off. Before landing, the selector switch should be positioned at MAIN. During the landing roll-out, after nose wheel touchdown, the stand-by steering system may be engaged with the rudder pedals at or about neutral.

† Airplanes not changed by T.O. 1T-39-771

‡ Airplanes changed to T.O. 1T-39-771

Caution If the nose wheel steering selector switch is in the STANDBY position during landing, the steering is energized at main gear touchdown and the nose wheels will be positioned proportional to rudder pedal position before nose wheel touchdown.

- When operating on the stand-by system with a failed main system, a subsequent failure will not result in a disconnection of the stand-by steering, and will require placing the electrical master switch momentarily at OFF or pulling the "NLG STEER - STBY" circuit breaker. Use stand-by steering with caution.

OPERATION WITH A KNOWN FAILED STAND-BY SYSTEM.

Before operation with a known failed stand-by system, disconnect and stow the electrical plug attached to the nose wheel steering stand-by control box CB515. (See figure 7-1.) This plug may be identified by the wiring bundle marked "CN515."

Warning Do not pull "NLG STEER - STBY" circuit breaker. When the circuit breaker is pulled, this results in de-energizing the main nose wheel steering transfer system, which would prevent free-castering in case of a main nose wheel steering system failure.

With the nose wheel steering selector switch at MAIN, engage or disengage the main steering system by use of the nose wheel steering button on

NOSE WHEEL STEERING CONTROL BOXES

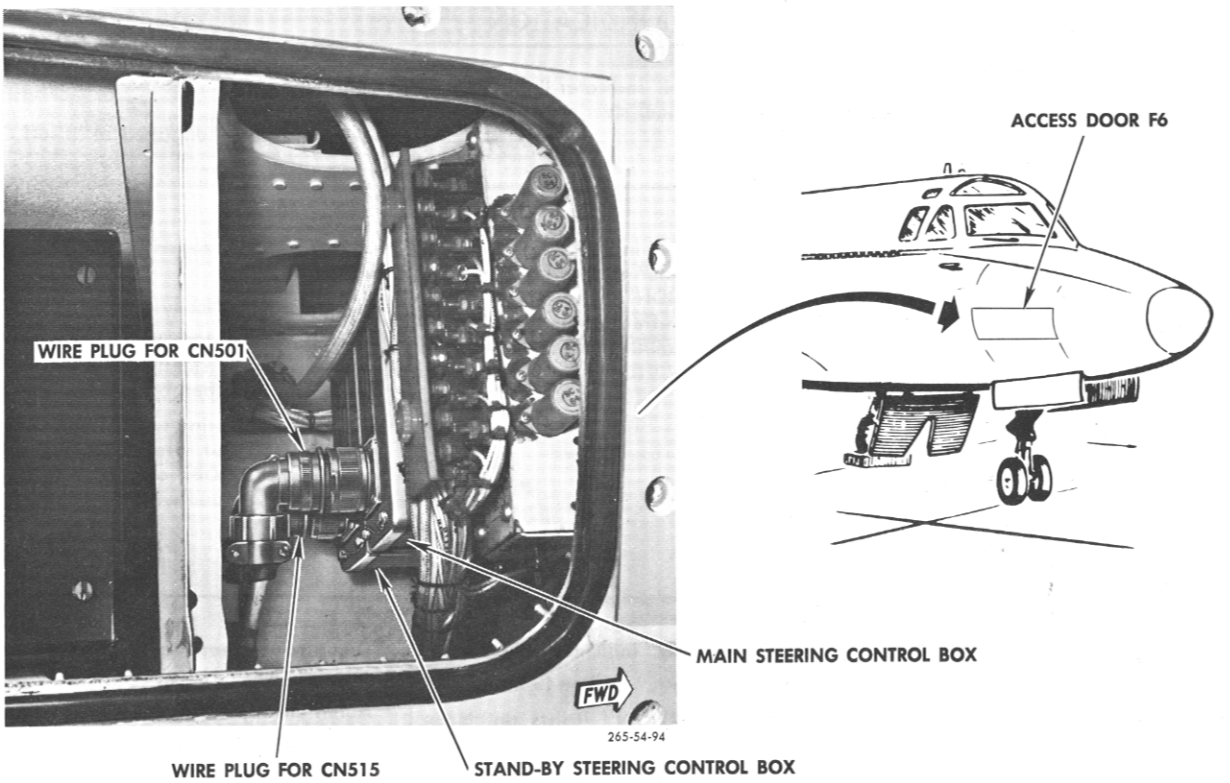

Figure 7-1

either control wheel. Any failure of the main nose wheel steering system would then result in a free-castering nose wheel.

ENGINE IDLE HANG-UP

NOTE The following paragraphs provide information regarding engine idle hang-up, its cause, and the action necessary to overcome it. It is anticipated that engineering changes in progress will eliminate the phenomenon, at which time this information will be deleted.

Engine idle hang-up is characterized by lower-than-normal idle rpm (37 percent) and failure to accelerate with throttle advances. Hang-up is most likely to occur after landing and should not occur in flight because of the ram-air effect. Certain conditions before take-off tend to indicate the engine which is prone to hang up after landing. An engine with a low idle rpm, less than 41 percent, and with cabin air, anti-icing, and generator loads is liable to hang up. Another indication is the engine that fails to accelerate from IDLE to Military Power in 10 seconds or less. In addition, all or a combination of the following tend to contribute to idle hang-up:

- Extended flight at high altitude
- Prolonged low-power descents
- High field pressure altitudes
- Warm ground temperatures
- Strong tail wind

These conditions cause the fuel control to schedule less than the idle steady-state fuel requirements. The hang-up caused by these conditions is usually temporary in nature and can be overcome. Should

NOSE WHEEL STEERING — OPERATION CHART

CONDITION	COCKPIT INDICATION	REMARKS
Normal operation (main system engaged). Steering selector switch at **MAIN**.	"NOSE STEER ON" indicator lights on. Normal nose wheel steering.	• Engage or disengage with either steering button. • Automatically disengaged at lift-off.
Main system failure (automatic transfer to stand-by system). Steering selector switch at **MAIN**. **NOTE** Subsequent failure of stand-by system will not result in an automatic transfer to main system.	"NOSE STEER ON" indicator lights on. "MAIN STEER FAIL" caution light on. "MASTER CAUTION" lights on. Steering buttons have no effect on disengagement. Nose wheels turn in response to rudder pedals.	• Cannot be disengaged with either steering button. • Will not automatically disengage at lift-off. † • After lift-off and before gear retracts, disengage by cycling steering selector switch to **STANDBY** and then back to **MAIN**. † • If the use of steering is contemplated during landing roll-out, place steering selector switch at **STANDBY** only after nose wheels are on runway and with rudder pedals at or about neutral.
Operation with a known failed main system (operation in this condition not recommended). Before operation, pull "NLG STEER — MAIN" circuit breaker.	"NOSE STEER ON" indicator lights on. "MAIN STEER FAIL" caution lights on. "MASTER CAUTION" lights on. Nose wheels turn in response to rudder pedals. Subsequent failure of stand-by system will not result in free-castering nose wheels. Free castering after failure of stand-by system can only be accomplished by placing steering selector switch at **MAIN**, or by pulling "NLG STEER — STBY" circuit breaker.	• Disengage steering by placing steering selector switch at **MAIN**. • Automatically disengaged at lift-off. • To avoid premature steering, the steering selector switch should be placed at **MAIN** before landing. Place steering selector switch at **STANDBY** for steering only after nose wheels are on the runway and with rudder pedals at or about neutral.
Operation with a known failed stand-by system (operation in this condition not recommended). Steering selector switch at **MAIN**. Before operation: a. Disconnect electrical plug from CN515 nose wheel steering stand-by control box and stow the plug. b. Leave steering selector switch at **MAIN**.	"NOSE STEER ON" indicator lights on. Nose wheels turn in response to rudder pedals. Subsequent failure of main system will result in free-castering nose wheels.	• Engage or disengage with either steering button. • Automatically disengaged at lift-off. **WARNING** Do not pull "NLG STEER — STBY" circuit breaker. This would prevent free castering in the event of a main nose wheel steering system failure.

† Airplanes not changed by T.O. 1T-39-771.

39A1-33-5A

Figure 7-2

an engine hang up, remove unnecessary load from the engine by turning off the following:

- Anti-icing
- Cabin air
- Windshield heat
- DC generators

In addition, avoid stopping the airplane in a strong tail wind condition with engines at IDLE. Leaving the throttle forward of IDLE until the engine stabilizes at or above normal idle rpm will assist recovery. If the hang-up is overcome and the engine reacts normally, there is no requirement to perform any maintenance. If the engine fails to recover, or recovers but does not respond normally to throttle movements, corrective maintenance is to be accomplished before the next flight. Also, if the engine hangs up on several successive flights, even though the engine recovers, maintenance should be performed.

CREW DUTIES

SECTION VIII

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INTRODUCTION.

In this section the primary and alternate duties of the basic flight crews are discussed. The basic flight crew consists of a pilot and copilot, with a navigator as an alternate crew member. This section does not include information already covered in Sections II and III. All duties connected with the actual flying of the airplane will be performed by the pilot or copilot.

PILOT.

It is the pilot's responsibility to ensure that a thorough inspection of the airplane and all equipment is properly conducted in sufficient time to permit correction of discrepancies without incurring delays. The pilot is responsible for briefing the crew and passengers for the proposed mission, and for directing action in case of emergencies. The pilot will make sure that all passengers have available, and are checked out in the proper use of, necessary emergency equipment. The pilot will also be responsible for determining whether the type of mission to be flown requires all personnel to wear parachutes throughout the flight. The pilot's checklist is contained in T.O. 1T-39A-1CL-1.

PASSENGERS' OXYGEN INSTRUCTION.

It is the pilot's responsibility to demonstrate for the passengers the proper use of the oxygen masks and to describe the functions of the passengers' signs and oxygen flow indicators. Although the oxygen system is put into operation automatically without passenger-operated controls, the procedure for manually removing the oxygen mask from the compartment will be demonstrated to the passengers. The "Passenger Safety Instructions" card, in the pocket on the back of each seat, describes the procedure for donning the oxygen mask.

After the demonstration, check all mask compartments for proper stowage of masks and "in-use" valves, and verify that all mask adjustment straps are fully released to permit quick donning of the masks.

CARGO LOADING INSTRUCTIONS.

It is the pilot's responsibility to ensure that all cargo is properly loaded and secured. A cargo loading instruction card, in the pouch behind the pilot's seat, gives loading instructions for two typical cargo configurations.

COPILOT.

The copilot will aid the pilot, as directed, in performing the assigned mission. For this reason, the copilot must be familiar with the pilot's duties as well as his own. The copilot will also use checklist T.O. 1T-39A-1CL-1.

NAVIGATOR.

The navigator performs navigation functions in coordination with the pilot and copilot. At the direction of the pilot, he performs dead-reckoning, radio, or celestial navigation as necessary. The navigator is responsible for determining before take-off that his equipment is available and that the instruments at his station that can be checked are functioning properly.

MISSION PLANNING.

Accomplish flight planning with the pilot and copilot.

PREFLIGHT CHECK.

Upon arrival at the airplane, check that the periscopic sextant and chartboard are properly stowed in the cabin and that maps and charts

necessary for the mission are available. Set the altimeter and check the free air temperature indicator reading against known free air temperature. Set intercommunication controls as briefed.

GROUND CHECKS.

After engine start, check for proper indications by BDHI pointers and compass card.

NOTE This check must be coordinated with the pilot, since he must tune in the available TACAN and VOR signals and relay the magnetic compass readings.

CLIMB.

During climb, check operation of the true airspeed indicator and the BDHI for proper indications. If celestial navigation is to be performed, install sextant in mount. Install the chartboard if required.

CRUISE.

Perform the required navigation and provide position reporting data to pilot as required.

BEFORE LANDING.

Stow sextant and chartboard in baggage compartment.

ALL-WEATHER OPERATION

SECTION IX

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This section consists of procedures and information that differ from, or supplement, the normal operating procedures in Sections II and IV.

INSTRUMENT FLIGHT PROCEDURES

This airplane has the same stability and flight characteristics during instrument flight conditions as when flown under visual flight conditions. However, like most jet airplanes, it is sensitive to changes of control pressures and power response, which requires a relatively high degree of instrument proficiency and conscientious preflight planning. The flight director system is the primary instrument reference source on this airplane, and is on the pilot's side. A conventional, round dial instrument panel is on the copilot's side. The airplane can be controlled solely by reference to instruments from either pilot's position.

INSTRUMENT TAKE-OFF.

Complete the normal taxiing and before take-off checks. (Refer to Section II.) Select appropriate navigational aids to be used for the departure, and set navigational instruments and switches as required. After aligning the airplane visually with runway centerline, check the HSI, BDHI, and magnetic compass against the runway heading. If desired, the bank steering bar may be used for directional information by moving the heading mode selector switch to MANUAL and setting the heading command marker under the top lubber line of the HSI. Set ADI by aligning the arrow on the pitch trim knob with the reference mark. This setting, in taxi attitude, should show an attitude of approximately 2 to 3 degrees nose down. Thus, the ADI will provide a picture of the airplane's in-flight attitude relative to a level-flight condition at normal cruise airspeeds. Take-off procedures during an instrument take-off are essentially the same as for a visual take-off. Advance throttles to Military Thrust with brake pedals depressed. If icing conditions are expected, turn on pitot heat, engine inlet, and wing and ram-air inlet anti-ice systems after Military Thrust is set. Release brakes, and maintain directional control with nose wheel steering until the rudder becomes effective.

NOTE Nose wheel steering may be used throughout the take-off roll; however, directional control becomes increasingly sensitive above 60 knots IAS.

The HSI is the primary source for heading control, but reference should be made to the bank steering bar, if used, and whatever outside reference is available. Use of windshield wipers may be required to improve forward visibility during precipitation. Using normal rotation airspeed, rotate smoothly to the take-off attitude (10-degree pitch change, from 2 to 3 degrees nose down to a 7- to 8-degree nose-up indication on the ADI). With the change in attitude, the airplane will become airborne as take-off speed is reached. As the airplane leaves the ground, reference should be made to the ADI for both pitch and bank until a definite climb is established. When the altimeter and vertical velocity indicator show a definite climb, retract landing gear.

INSTRUMENT CLIMB.

An instrument climb is accomplished in the same manner as a visual climb by maintaining a 7- to 8-degree nose-up indication on the ADI until inter-

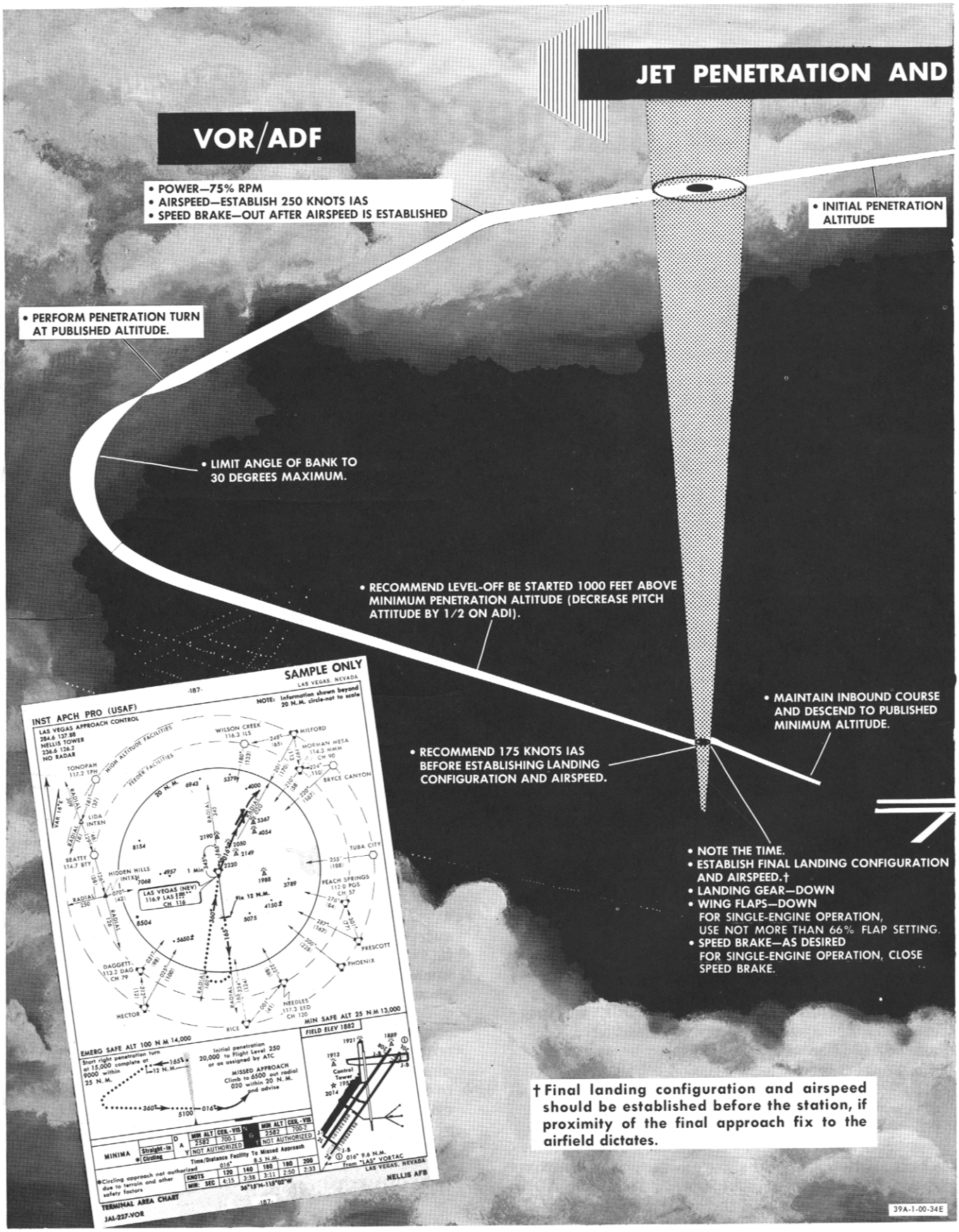
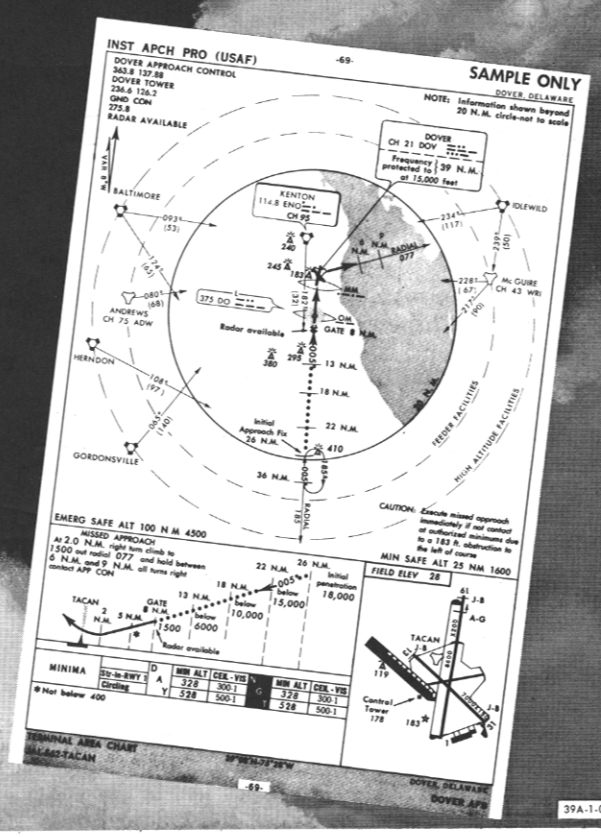

JET PENETRATION AND
VOR/ADF
• POWER—75% RPM
• AIRSPEED—ESTABLISH 250 KNOTS IAS
• SPEED BRAKE—OUT AFTER AIRSPEED IS ESTABLISHED
• INITIAL PENETRATION ALTITUDE
• PERFORM PENETRATION TURN AT PUBLISHED ALTITUDE.
• LIMIT ANGLE OF BANK TO 30 DEGREES MAXIMUM.
• RECOMMEND LEVEL-OFF BE STARTED 1000 FEET ABOVE MINIMUM PENETRATION ALTITUDE (DECREASE PITCH ATTITUDE BY 1/2 ON ADI).
• MAINTAIN INBOUND COURSE AND DESCEND TO PUBLISHED MINIMUM ALTITUDE.
• RECOMMEND 175 KNOTS IAS BEFORE ESTABLISHING LANDING CONFIGURATION AND AIRSPEED.
• NOTE THE TIME.
• ESTABLISH FINAL LANDING CONFIGURATION AND AIRSPEED.†
• LANDING GEAR—DOWN
• WING FLAPS—DOWN
FOR SINGLE-ENGINE OPERATION, USE NOT MORE THAN 66% FLAP SETTING.
• SPEED BRAKE—AS DESIRED
FOR SINGLE-ENGINE OPERATION, CLOSE SPEED BRAKE.
SAMPLE ONLY
INST APCH PRO (USAF)
LAS VEGAS, NEVADA
LAS VEGAS APPROACH CONTROL
284.6 137.88
NELLIS TOWER
236.6 126.2
NO RADAR
NOTE: Information shown beyond 20 N.M. circle-not to scale
TERMINAL AREA CHART
JAL-227-VOR
NELLIS AFB
† Final landing configuration and airspeed should be established before the station, if proximity of the final approach fix to the airfield dictates.
39A-1-00-34E

Figure 9-1

LOW APPROACH (TYPICAL)

TACAN

- INITIAL PENETRATION ALTITUDE
- POWER—75% RPM
- AIRSPEED—ESTABLISH 250 KNOTS IAS
- SPEED BRAKE—OUT AFTER AIRSPEED IS ESTABLISHED
- RECOMMEND LEVEL-OFF BE STARTED 1000 FEET ABOVE MINIMUM PENETRATION ALTITUDE (DECREASE PITCH ATTITUDE BY 1/2 ON ADI).
- RECOMMEND 175 KNOTS IAS BEFORE ESTABLISHING LANDING CONFIGURATION AND AIRSPEED.
- MAINTAIN INBOUND COURSE AND DESCEND TO PUBLISHED MINIMUM ALTITUDE.
- CROSS THE GATE AT PUBLISHED ALTITUDE.
- NOTE THE TIME.
- ESTABLISH FINAL LANDING CONFIGURATION AND AIRSPEED.†
- LANDING GEAR—DOWN
- WING FLAPS—DOWN
  FOR SINGLE-ENGINE OPERATION, USE NOT MORE THAN 66% FLAP SETTING.
- SPEED BRAKE—AS DESIRED
  FOR SINGLE-ENGINE OPERATION, CLOSE SPEED BRAKE.



† Final landing configuration and airspeed should be established before the gate, if proximity of the final approach fix to the airfield dictates.

cepting the climb schedule. Turns immediately after take-off should be delayed until at least 150 knots IAS. Maximum bank angles of 30 degrees are normally used during climbing turns.

INSTRUMENT CRUISING FLIGHT.

Instrument cruise procedures do not differ from normal flight procedures. For ease and precision of flight, the angle of bank should be limited to 30 degrees during all turns.

RADIO NAVIGATION EQUIPMENT.

Refer to Section IV for operation of radio and navigation equipment.

NOTE TACAN and IFF are inoperative with loss of the main inverter.

HOLDING.

The recommended holding airspeed is 200 knots IAS with clean configuration at all altitudes and gross weights; however, a lower airspeed may be used at low altitudes.

INSTRUMENT LETDOWNS.

Jet Penetrations.

Instrument descents to initial penetration altitude, before reaching destination fix, may be made at the airspeeds and power settings given in the descent charts in Part 5 of Appendix I. For a normal penetration, starting at initial penetration altitude, reduce thrust to 75 percent rpm, lower pitch attitude to approximately 10 degrees nose down on the ADI (pitch trim knob aligned) to establish 250 knots IAS. As the airspeed approaches 250 knots IAS, extend the speed brake and maintain 250 knots IAS.

NOTE Idle rpm may be used if no icing conditions are expected.

Comply with the published instrument approach procedure while descending to the minimum penetation altitude. For ease of airplane control, all turns should be limited to 30 degrees of bank angle. Start level-off from a penetration when 1000 feet above the minimum penetration altitude by decreasing the pitch attitude on the ADI by one half. After level-off, reduce airspeed to 175 knots IAS and use the speed brake as desired. (See figure 9-1 for typical penetration.)

Instrument Approach.

Flight characteristics during instrument approaches do not differ from those encountered during normal visual flight. Normally, 175 knots IAS is used for all maneuvering before extending the landing gear. Landing configuration and airspeed are normally established during final approach at the VOR station or TACAN gate.

If a circling approach is required, wing flaps and speed brake may be delayed and normal landing pattern speeds used.

For precision radar and ILS approaches, landing gear and full flaps should be extended and final approach airspeed established before intercepting the glide path. The speed brake should then be extended at the time of glide-path interception. In rain or snow, use of the windshield wipers will increase forward visibility. Large or abrupt throttle movements should be avoided as engine response is rapid. (See figures 9-2 and 9-3 for typical radar and ILS approaches.)

Warning Avoid extreme nose-high attitudes on the glide path. At high angles of attack, an excessive sink rate may develop unnoticed.

NOTE Fuel indications may vary in error as much as 200 pounds because of changes in the airplane attitude during a penetration or approach.

Missed Approach.

Advance throttles as required, retract speed brake, and establish a 7- to 8-degree nose-up attitude on the ADI (pitch trim knob aligned).

NOTE Abrupt use of Military Thrust, when initiating the missed approach, will result in excessive acceleration and climb rates and may produce undesirable yaw because of uneven acceleration. Smooth and positive throttle movement technique is recommended to minimize these tendencies.

- Retract the landing gear and wing flaps when a definite climb is indicated on the altimeter and vertical velocity indicator. Execute the published missed approach procedure. If another approach is to be executed, level off at missed approach altitude, and adjust thrust to maintain 175 knots IAS. If a climb to altitude is desired, adjust throttles to Military Thrust and intercept the climb schedule.

Single-engine Approach.

Single-engine characteristics are excellent. Larger than normal thrust settings must be expected, necessitating considerable rudder trim to offset the differential yaw. In addition to the techniques and procedures noted under "Instrument Approach," the following configuration changes are recommended: wing flaps set at zero to maximum of 66 percent, and

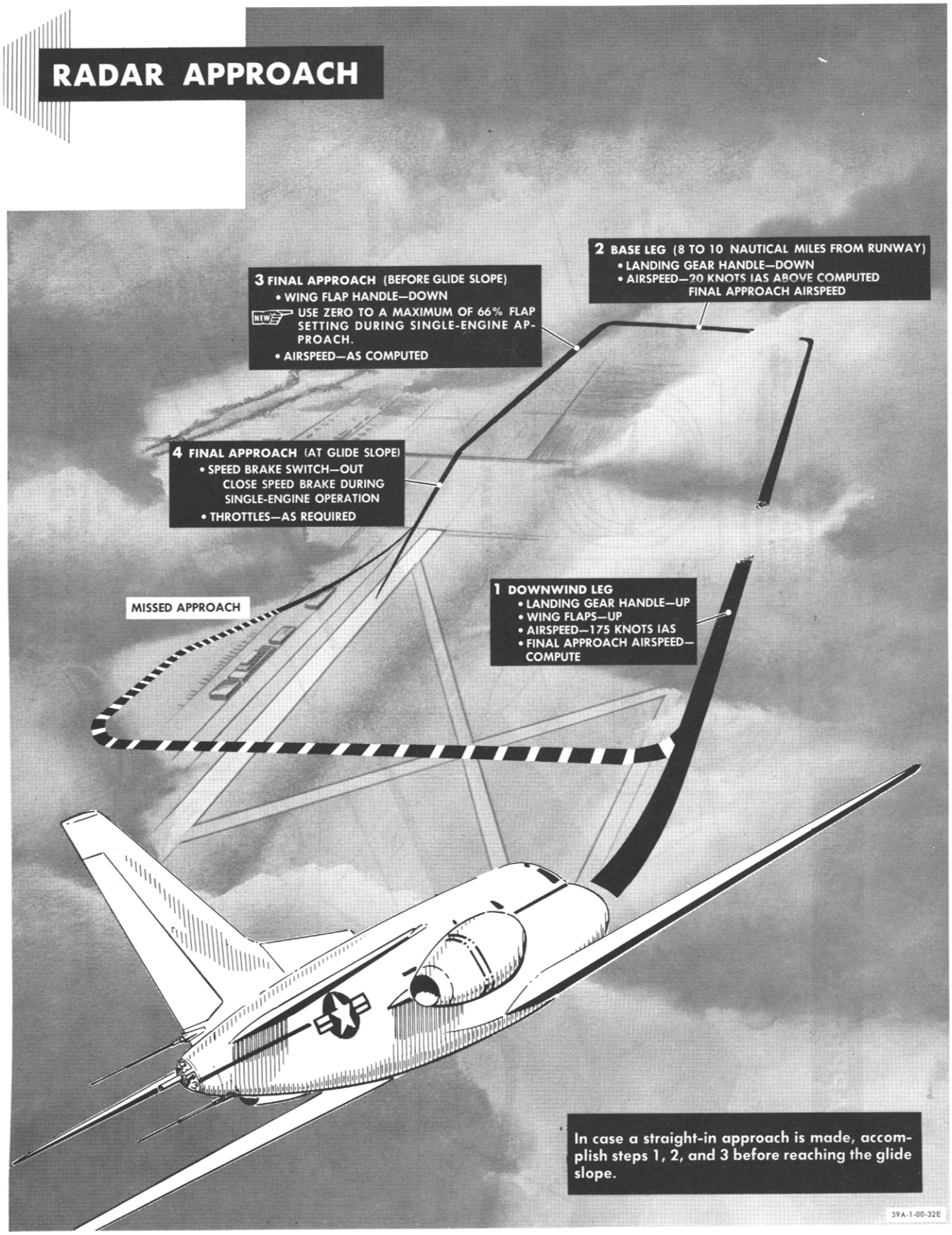

RADAR APPROACH
2 BASE LEG (8 TO 10 NAUTICAL MILES FROM RUNWAY)
• LANDING GEAR HANDLE—DOWN
• AIRSPEED—20 KNOTS IAS ABOVE COMPUTED FINAL APPROACH AIRSPEED
3 FINAL APPROACH (BEFORE GLIDE SLOPE)
• WING FLAP HANDLE—DOWN
NEW USE ZERO TO A MAXIMUM OF 66% FLAP SETTING DURING SINGLE-ENGINE APPROACH.
• AIRSPEED—AS COMPUTED
4 FINAL APPROACH (AT GLIDE SLOPE)
• SPEED BRAKE SWITCH—OUT
CLOSE SPEED BRAKE DURING SINGLE-ENGINE OPERATION
• THROTTLES—AS REQUIRED
MISSED APPROACH
1 DOWNWIND LEG
• LANDING GEAR HANDLE—UP
• WING FLAPS—UP
• AIRSPEED—175 KNOTS IAS
• FINAL APPROACH AIRSPEED—COMPUTE
In case a straight-in approach is made, accomplish steps 1, 2, and 3 before reaching the glide slope.
39A-1-00-32E

Figure 9-2

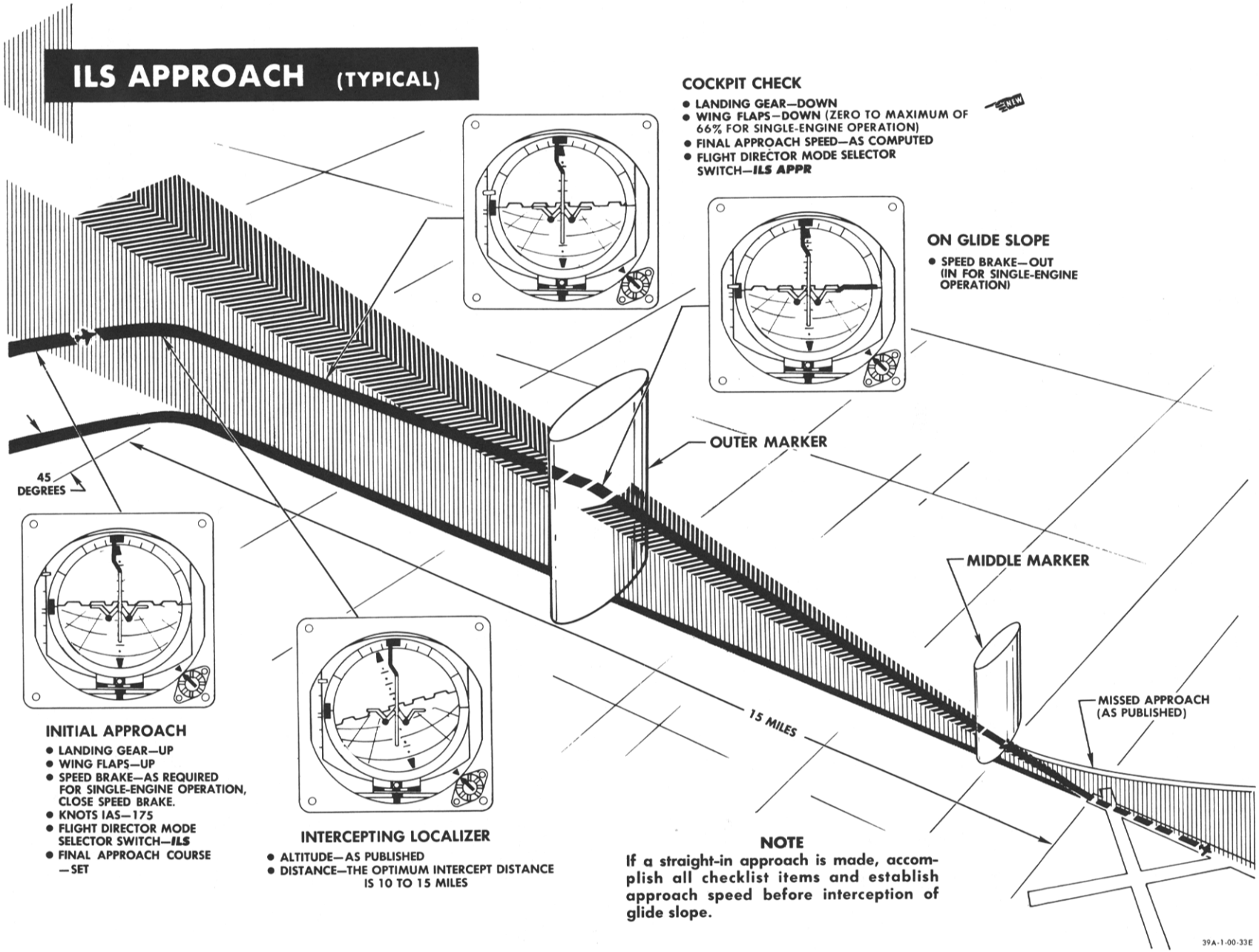

ILS APPROACH (TYPICAL)
COCKPIT CHECK
• LANDING GEAR—DOWN
• WING FLAPS—DOWN (ZERO TO MAXIMUM OF 66% FOR SINGLE-ENGINE OPERATION)
• FINAL APPROACH SPEED—AS COMPUTED
• FLIGHT DIRECTOR MODE SELECTOR SWITCH—ILS APPR
NEW
ON GLIDE SLOPE
• SPEED BRAKE—OUT (IN FOR SINGLE-ENGINE OPERATION)
OUTER MARKER
45 DEGREES
MIDDLE MARKER
MISSED APPROACH (AS PUBLISHED)
15 MILES
INITIAL APPROACH
• LANDING GEAR—UP
• WING FLAPS—UP
• SPEED BRAKE—AS REQUIRED FOR SINGLE-ENGINE OPERATION, CLOSE SPEED BRAKE.
• KNOTS IAS—175
• FLIGHT DIRECTOR MODE SELECTOR SWITCH—ILS
• FINAL APPROACH COURSE —SET
INTERCEPTING LOCALIZER
• ALTITUDE—AS PUBLISHED
• DISTANCE—THE OPTIMUM INTERCEPT DISTANCE IS 10 TO 15 MILES
NOTE
If a straight-in approach is made, accomplish all checklist items and establish approach speed before interception of glide slope.
39A-1-00-33E

Figure 9-3

speed brake IN. Maintain the recommended single-engine approach airspeed. When the landing is ensured, wing flaps may be lowered and speed brake extended.

Single-engine Missed Approach.

Make the decision for a go-around as early as possible. Advance throttle smoothly to Military Thrust. Anticipate strong rudder pressure to offset differential yaw effects. Use rudder trim as necessary. Follow normal missed-approach procedures. If a climb to altitude is desired, maintain Military Thrust and climb at a constant airspeed of 180 knots IAS.

ICE AND RAIN

Flight through areas of known or forecast icing conditions is not recommended. Flights through areas of icing conditions may be made; however, flight time should be limited to periods of short duration such as climbs and descents.

AIRPLANE ICING.

This airplane is equipped with anti-icing systems for the engine inlet area, wing leading edge (inboard of the slats), ram-air inlet, side and overhead windshields, and forward windshields. (Refer to Section IV for operation of these systems.) The airplane is also equipped with pitot heat and windshield wipers. The performance capabilities of the airplane should be utilized to avoid icing conditions. The resultant drag and weight increase associated with structural icing acts to reduce the airspeed and to increase thrust requirements, with consequent reduction in range. Rain, without icing conditions, has little, or no, appreciable effect on the flight characteristics.

NOTE Flight within an area having icing conditions may result in erroneous airspeed and Mach indications, even though pitot heat is turned on before entering the area. The attitude indicator, altimeter, vertical velocity, and known thrust settings can be used with an acceptable degree of accuracy during this flight condition.

ENGINE ICING.

Icing of the engine inlet is possible during operation in weather with temperatures near the freezing point. Low airspeed and low engine rpm are most conducive to engine icing. An increase in fuel flow and decrease of rpm, with a loss of thrust (no mechanical difficulties present) usually indicates engine icing. A compressor stall may indicate engine icing.

Caution If the exhaust temperatures increase, as a result of engine icing, the throttles should be retarded immediately and an effort made to leave the icing area.

If icing conditions are encountered and the airplane subsequently enters an area where temperatures are above the freezing point and structural ice is still present, the engines should be operated at the lowest practical rpm to minimize possible engine damage. Normal engine operation can be resumed after the airplane is free of ice.

Caution Ice can break loose from the airplane forward of the engine inlets and be ingested into the engine with resultant damage to compressor blades.

This airplane can be operated in areas of ice crystals (sometimes encountered as cirrus clouds at high altitude) without encountering any engine problems. If ice accumulation is noted, airplane altitude should be changed immediately to leave the area of icing conditions. Normally, no power loss will occur when ice is ingested into the engines; however, if ice is inadvertently encountered, the engines should be inspected for damage after landing.

OPERATION IN RAIN OR ICING CONDITIONS.

Ground Operation.

Operate the airplane and systems as indicated in "Cold-weather Procedures," in this section. The windshield wipers can be used to improve forward visibility during precipitation.

Take-off and Initial Climb.

Turn on the appropriate anti-ice systems before take-off. (Refer to Section IV for operating procedures.) If possible, take-offs should be avoided when the temperature is between -10°C (14°F) and 5°C (41°F), and either fog is present or the dew point is within 4°C (7°F) of the free air temperature. These are conditions under which engine icing can occur without wing icing. Refusal speeds will be considerably lower than normal and stopping distances much greater on wet or icy runways.

Cruise.

Operate the airplane, as necessary, to avoid icing conditions whenever possible. If icing conditions

are encountered, immediate action should be taken as follows:

1. Change altitude rapidly by climbing or descending, or vary course to prevent ice accumulation on the airplane structure.

2. Reduce airspeed to minimize rate of ice build-up. Airspeed should not be reduced to less than slat-opening speed, to prevent slats freezing in the open position.

3. Monitor exhaust temperatures and reduce rpm, as necessary, to prevent excessive exhaust temperatures.

Descent.

Turn on appropriate anti-icing systems before descending into icing conditions.

Caution Seventy-five percent rpm is required to provide adequate compressor bleed air for engine anti-icing.

Approach and Landing.

Visually check the airplane leading edges for indication of structural icing. If at night, the wing ice-check lights may be used for this purpose.

Warning Ice accumulation greatly increases the stalling speed; therefore, airspeed should be increased during approach and landing under these conditions.

NOTE Erratic or erroneous pitot-static instrument indications may occur while flying in heavy rain during final approach for landing. If these erratic indications do occur, select alternate static-pressure source. Use of alternate static-pressure source will result in an indicated airspeed of approximately 5 knots lower than with the normal system, and an indicated altitude approximately 60 feet lower than with the normal system. The final approach airspeeds and altimeter indications are recommended for use when operating on the alternate pitot-static system.

Use of the windshield wipers will increase forward visibility during periods of precipitation such as rain or snow. Use of windshield heat should preclude ice accumulation on the forward windshields.

Caution Use of windshield wipers should be limited to a maximum of 180 knots IAS. Landing distance computation must be based on the runway condition (wet, icy, etc,) and the appropriate stopping factor applied. The approach and braking technique for a slippery runway is the same as a minimum-roll landing. (Refer to Section II.) Strict adherence to the correct final approach airspeed is essential. If stopping distance is critical, it may be necessary to shut down one or both engines after touchdown, to shorten the landing roll. (Refer to "Landing," under "Cold-weather Procedures," in this section for braking technique.)

TURBULENCE AND THUNDERSTORMS

SEVERE TURBULENT AIR PENETRATION.

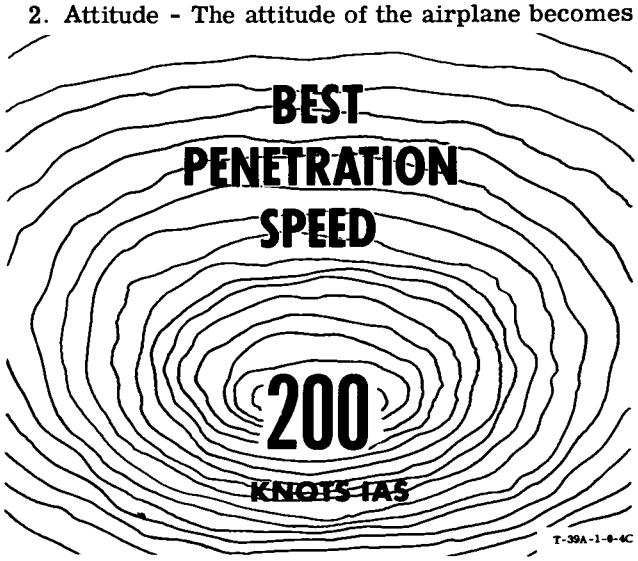
Caution The potential danger of thunderstorms is statistical history. Never enter them by choice.

Flight through the areas of severe turbulence associated with thunderstorm activity should be avoided. Whenever marginal conditions are indicated, or doubt exists as to the severity of unknown weather conditions, thorough preplanning with the weather forecaster must be accomplished. Careful planning and good judgment must be exercised and capabilities realized before areas of weather activity are entered or circumnavigated.

Should flight through an area of thunderstorm activity be necessary, the recommended procedures for flight in severe turbulence are:

1. Airspeed - A gust penetration speed of 200 knots IAS should be established. Trim the airplane for level flight at this speed. Severe turbulence will cause large and often rapid variations in indicated airspeed. Do not chase the airspeed.

2. Attitude - The attitude of the airplane becomes



the primary reference in areas of extreme turbulence. After establishing the airplane attitude and trim setting for the target airspeed of 200 knots IAS, use the attitude indicator as the primary instrument. Do not change the trim settings after the proper attitude has been established. Fly this attitude during turbulent conditions. Maintain control as near neutral as possible to avoid exaggerating the flight conditions by overcontrolling. Do not use sudden or extreme control inputs. Extreme gusts will cause large attitude changes, but smooth and moderate use of the elevator will reestablish the desired attitude. Be very conscious of tendencies to overcontrol with the rudder at this time. Attempt to maintain neutral rudder at all times.

3. Altitude - Severe vertical gusts may cause appreciable altitude variations. Allow altitude to vary. Sacrifice altitude to maintain the desired attitude and airspeed. Do not chase the altimeter.

4. Thrust - Establish and maintain the thrust setting consistent with the desired penetration speed and attitude. Change thrust only in case of extreme airspeed variation.

ENGINE SURGE AND FLAME-OUT CAUSED BY ADVERSE WEATHER CONDITIONS.

The following factors, singly or in combination, can cause engine flame-out:

1. Penetration of cumulus build-ups with associated high liquid content.

2. Disrupted airflow due to engine inlet and guide vane icing.

3. Turbulence associated with penetration can result in excessive nose-up angles of attack, causing marginal engine performance.

4. Above 45,000 feet, engine-surge margin is reduced and there is poor air distribution across the face of the compressors.

Caution Flying in turbulence or hail may increase inlet duct distortion. At higher altitudes, this distortion can result in engine surge and possible flame-out. However, normal air starts may be accomplished, as outlined in Section III.

Areas of turbulent air, hailstorms, or thunderstorms should be avoided whenever possible, because of the increased danger of engine flame-out.

Exhaust temperature and exhaust total pressure gages should be monitored continuously during weather penetration. Exhaust temperature indication alone may come too late to allow timely corrective action. The engine inlet anti-icing system prevents the formation of ice and is not a deicer. When possible, icing conditions should be anticipated in advance and the engine inlet anti-icing system should be turned on to warm up the engine air inlet. If ice has already begun to build up before the engine inlet anti-icing system is turned on, the throttle setting should be reduced to minimize danger of internal engine damage until all ice has been broken off and ingested by the engines. When the presence of ice is no longer evident, the engines should be checked at idle and the throttles should be advanced to the desired setting.

NIGHT FLYING

There are no specific techniques for flying this airplane at night that differ from those for day flight.

NOTE The wing ice-check lights are very discernible at night and may be used to supplement the anti-collision and position lights.

- The emergency lighting system should be tested and armed just before the engines are started, and disarmed following engine shutdown. The system should never be used to light the interior of the airplane for clean-up or maintenance work.

COLD-WEATHER PROCEDURES

The majority of cold-weather operating difficulties are encountered on the ground. The following instructions supplement the normal operating instructions when arctic-type weather is encountered. Extreme diligence on the part of both the ground and flight crews is the answer to successful arctic operation.

BEFORE ENTERING AIRPLANE.

1. Perform exterior inspection as outlined in Section II.

2. Check to ascertain that the entire airplane is free of snow, frost, and ice.

Warning Depending on the weight and distribution of the snow and ice, take-off distances and climb-out performance can be adversely affected. The roughness, pattern, and location of the snow and ice can affect stall speeds and handling characteristics to a dangerous degree. In-

flight structural damage may also result, because of the vibrations induced by unbalanced loads of accumulated ice and snow.

Caution Do not chip or scrape ice from airplane surface, as this may cause damage.

3. Check to see that engines are free of internal ice and rotate freely by hand.

4. Ensure that the hydraulic accumulator has been properly precharged for the existing temperatures.

5. Ensure that all dirt and ice is removed from landing gear shock struts, actuating cylinder pistons, and all limit switches.

6. Inspect the area behind the airplane to ensure that loose snow and ice will not be blown onto personnel, other airplanes, or equipment during engine start.

ENTERING AIRPLANE.

1. Use caution on the entrance door steps. The metal steps (if not covered with strips or rubber matting) become extremely slippery, as snow, ice, or water is deposited by personnel entering the airplane.

ALTERNATE FUEL USE.

When alternate fuels are used, specific attention must be given to observance of the alternate fuel limitations as given in Section V.

NOTE Ground and air starts may be more difficult in cold temperatures when using JP-5 fuel.

STARTING ENGINE.

1. At temperatures below 0°F (-18°C), external dc electrical power should always be available to ensure starting. Airplane battery power is not adequate to provide the rpm required for normal starting after the airplane has been exposed to below-zero temperatures for a 24-hour period or longer.

2. Successful battery starts can be made at temperatures as low as -20°F when the engines have been shut down for periods up to 4 hours.

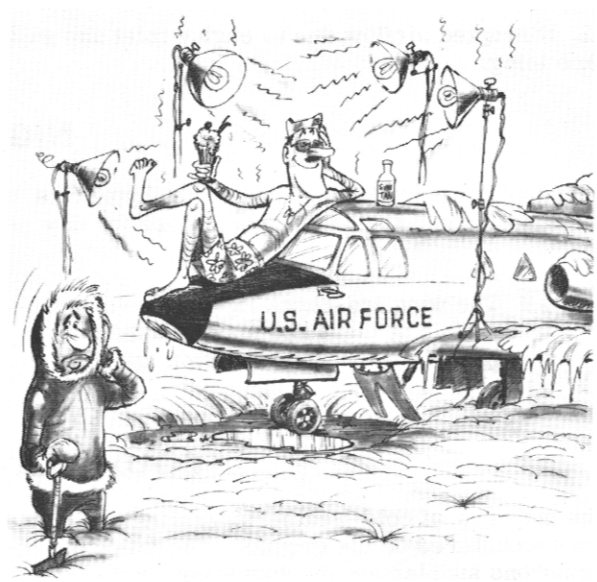
Caution If the airplane has been "cold soaking" overnight at -40°F, or below, engine starts should not be attempted without first preheating the fuel control for 10 to 15 minutes with a portable ground heater. This procedure will prevent serious fuel flow surges during engine acceleration to IDLE and eliminates the dangers of a hot start or excessive engine accelerations.

- It is possible to obtain successful engine starts at low temperatures by placing the throttle in IDLE at approximately 9 percent of engine rpm. Extreme caution must be exercised, and starts should not be attempted at less than 9 percent of engine rpm. Fuel flow and exhaust gas temperature should be closely monitored, and the throttle should be stopcocked if the exhaust gas temperature or the fuel flow limits are exceeded.

NOTE If starting rpm cannot be reached on the first start attempt, subsequent start attempts may produce higher rpm. A minimum of 2 minutes should be observed between start attempts.

WARM-UP AND GROUND CHECK.

Normally, engine warm-up is unnecessary and as soon as the engine stabilizes at idle rpm with normal oil pressure, the throttle may be advanced to Military Thrust. However, if the engine has been "cold soaked" at temperatures of -31°F (-35°C) or below, a 2-minute warm-up at **IDLE** will be required.



WARNING

Make sure all instruments have warmed up sufficiently to ensure normal operation. Check flight instruments for sluggishness during taxiing.

T-39A-1-0-3

TAXIING.

1. Taxi at slow speed when taxiing over rough, snow-packed surface.

Caution The tubeless nose wheel tires may go flat while taxiing at -20°F, or below. This is caused by the tires "working" in the ruts of the snow-packed taxiway and pulling loose around the tire bead seal. To prevent this, heat should be applied to the nose gear tires for 15 to 20 minutes before taxiing, or tubes should be installed for continuous low-temperature operation.

- When operating in snow, the speed brake must be retracted, as damage could result from snow piling up in front of the speed brake and main gear doors.

2. When the nose wheel is centered, the steering system is designed to provide a less rigid or sudden steering control. This is to provide the optimum steering on dry, smooth surfaces and to prevent small rudder deflections, while taxiing or during take-off, from causing abrupt directional changes. However, when taxiing on icy, rutted, or rough snow-packed surfaces, the lack of this positive, hard control may be noticeable, and extra precaution must be exercised to maintain good steering control during these conditions.

3. By taxiing on the side of the taxiway off the crown, good steering can be maintained with the nose wheel out of the centered position.

4. Increase distance between airplanes while taxiing at subfreezing temperatures, to ensure safe stopping distance and to prevent icing of airplane surfaces by melted snow and ice picked up by the jet blast of a preceding airplane.

BEFORE TAKE-OFF.

Make normal full-power engine check. However, if field conditions make this impossible, final checks must be made during the first part of the take-off roll.

Caution Take-off from a runway covered with a considerable accumulation of wet snow or slush is not recommended. Accumulation of heavy slush and subsequent freezing in the right wheel well may cause a partial obstruction of aileron movement.

TAKE-OFF.

During low-temperature take-off, the airplane acceleration and performance is improved, and the landing gear handle must be placed in the UP position as soon as there is a definite climb established, to avoid exceeding the gear-down limit speed.

AFTER TAKE-OFF.

1. After take-off from a wet snow-covered or slush-covered field, operate landing gear through several complete cycles to prevent gear freezing in retracted position. (Expect considerably slower operation of landing gear in cold weather because of stiffening of all lubricants.)

LANDING.

Use slippery-runway landing procedures in Section II.

NOTE Aerodynamic braking is particularly ineffective during cold temperatures when the idle thrust from the engines is high. Braking should be commenced as soon as the nose wheel is on the runway, since braking is relatively good at high speed when landing on snow-packed runways. At speeds below 45 knots IAS, it is extremely difficult to keep from locking the wheels while attempting to stop.

- The landing roll can be substantially reduced by shutting one or both engines off after touchdown, if stopping distance is critical.

AFTER LEAVING AIRPLANE.

1. Whenever possible, leave airplane parked with full fuel tanks.

2. Check that batteries are removed when airplane is parked outside at temperatures below -20°F (-29°C) for more than 4 hours.

3. Leave pilot's sliding window partially open to allow air circulation within airplane to decrease windshield frosting.

4. Close entrance door.

5. Check that proper protective covers are installed on airplane.

HOT-WEATHER AND DESERT PROCEDURES

Hot-weather and desert procedures differ from normal procedures when high temperatures, coupled with blowing sand and dust, are encountered. Extreme precaution must be exercised

by both the ground and flight crews to prevent damage to the airplane systems during desert operations. Proper protection and inspection of the airplane while it is on the ground and observance of the precautions covered in this section will ensure the most successful operation.

BEFORE ENTERING AIRPLANE.

1. Cool the pressurized compartments with a portable air conditioner, if one is available.

2. Remove all protective covers and dust plugs.

3. Inspect tires and shock struts for proper inflation.

4. Clean dust and sand from struts, hydraulic pistons, and limit switches.

5. Inspect door and escape hatch seals for deformation and damage due to high temperatures.

6. Check the wing slats for proper movement.

7. Always place the airplane in a position to avoid sandblasting the equipment, other airplanes, and personnel during engine starts and run-up.

8. Check the intake ducts and remove any accumulation of dust and sand.

ON ENTERING AIRPLANE.

1. Check instruments and electrical equipment for excessive moisture from high humidity, and ground-heat them, if necessary, to dry them.

2. Check cockpit for excessive accumulations of dust or sand.

NOTE High cockpit temperatures may cause circuit breakers to pop.

- If the airplane is exposed to direct sun or high temperatures, the windshield overheat caution light may come on.

GROUND OPERATION.

1. Expect the engines to accelerate to idle more slowly than on a normal or cold day.

2. Minimize the duration of engine ground operation.

3. Limit use of brakes during taxiing to prevent overheating.

4. Keep sufficient distance between airplanes during taxiing to prevent sand and dust from being blown into the engines.

TAKE-OFF.

Delay rotation, if the take-off roll is not critical, until reaching take-off speed, to provide positive control and a higher initial rate of climb.

Warning Take-off planning is of prime importance when operating from a marginal-length runway with high ambient temperatures. (Refer to appropriate charts in Part 2 of Appendix I.)

NOTE Excessive moisture condensation may occur through the cabin pressurization system. This condensation may become extremely dense within the passenger compartment and cause undue concern or apprehension among the passengers. The amount of condensation can be reduced by moving the cabin air temperature rheostat to a warmer selection.

APPROACH AND LANDING.

Maintain recommended approach and landing speeds as shown in Appendix I. Allow for longer landing rolls resulting from slightly increased ground speeds with high outside air temperatures.

Caution Hot-weather operation requires the pilot to be cautious of gusts and wind shifts near the ground.

Use all available runway for stopping to avoid overheating the wheel brakes and prevent tire failure.

Warning After a minimum-roll landing or excessive braking, do not attempt any further operation for at least one hour. All personnel should be warned to stay clear of the main landing gear areas until the brakes have cooled.

AFTER LEAVING AIRPLANE.

1. Make sure that protective covers are installed on pitot heads and intake and exhaust ducts.

2. Close entrance door, and cockpit window.

NOTE No unusual problems should develop if the airplane is kept closed during high-temperature periods.

3. Tie the airplane down if a possibility of windstorms exists.

NOTE Tie-down fittings are stored in the baggage compartment.

PERFORMANCE DATA

APPENDIX I

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PART 1-INTRODUCTION

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INTRODUCTION

SCOPE AND ARRANGEMENT.

The flight performance charts in this section provide data for accurate preflight planning. Two types of charts are included: (1) profile-type charts for operational and maximum range; and (2) graphical charts for take-off, climb, descent, and landing. The profile-type charts are provided for "quickie mission planning." These charts are optimized for no-wind conditions and are based on specific Mach numbers to aid flight planning by reducing the number of computations that must be made. A discussion and explanation of the use of the charts is provided.

DESCRIPTION OF PERFORMANCE PRESENTATION.

Basically, mission planning with these charts involves nothing more than the determination of each leg of the mission and the summarizing of these legs to determine the time, fuel, distance, etc.

PERFORMANCE DATA BASIS.

Flight planning information shown is based on NAA flight test and the T-39A Category II performance test program. All charts are based on ICAO Standard Day atmospheric conditions; however, corrections for nonstandard atmospheric conditions have been included on the charts.

DEFINITIONS AND AIRSPEED, ALTITUDE, AND TEMPERATURE CORRECTIONS.

DEFINITIONS.

Altimeter position correction - That figure (in feet) which, when applied to the indicated pressure altitude, gives calibrated pressure altitude.

Approach speed - That speed in IAS (which varies with gross weight) that is 130 percent of V_S.

ICAO Standard atmosphere - International Civil Aviation Organization.

Calibrated pressure altitude - The indicated pressure altitude corrected for installation effects.

CAS - Calibrated airspeed is indicated airspeed corrected for installation effects.

Decision speed - Refusal speed or rotation speed, whichever is less.

EAS - Equivalent airspeed is calibrated airspeed corrected for compressibility effects.

Free air temperature - Outside air temperature (ambient).

GS - Ground speed is true airspeed corrected for wind.

Ground minimum control speed (V_{MCG}) - The minimum airspeed on the ground at which the airplane is controllable with rudder and ailerons only, when an engine fails suddenly and the remaining engine is at Military Thrust.

IAS - Indicated airspeed is the reading taken from the airspeed indicator.

Indicated altitude - The reading of the pressure altimeter with the actual sea-level pressure set in the window.

Indicated air temperature - The reading taken from the free air temperature indicator.

Indicated pressure altitude - The reading of the pressure altimeter when set to a barometric pressure of 29.92 in. Hg.

Operational range - Optimum trade-off between increased cruise speeds and speeds for maximum range which results in a minimum loss of range.

RCR - Runway condition reading.

TAS - True airspeed is equivalent airspeed corrected for atmospheric density.

V_S - Stall speed with engines at zero thrust.

INSTALLATION CORRECTION.

Because of the position of the airspeed static-pressure source, a correction must be applied to the CAS to obtain IAS. For approach airspeeds and configurations (full or partial flaps), add one knot to CAS to obtain IAS. For other airspeeds and configurations, add 2 knots to CAS to obtain IAS. As the airplane approaches a stall, regardless of configuration, add 3 knots to CAS to obtain IAS.

ALTITUDE CORRECTION.

Because of the position of the altimeter static-pressure source, a correction must be applied to the calibrated pressure altitude to obtain indicated pressure altitude. This correction can be obtained from the charts in figure A1-1. Instrument error is the only difference between calibrated pressure altitude and true pressure altitude. Since this chart does not consider instrument error, true pressure altitude may be considered the same as calibrated pressure altitude.

AIR TEMPERATURE CORRECTION.

Because of compressibility and installation errors, the indicated air temperature must be corrected to obtain the calibrated air temperature. This correction is incorporated into figure A1-2, and free air temperature can be read directly from the chart when indicated Mach number and indicated temperature are known.

The J201 computer may be used to obtain free air temperature (static) when referral to the free air temperature chart is not practical. (Refer to Part 7 of Appendix I.) Certain other computers enable computing the error of temperature indicating systems when the recovery coefficients for the systems are known. With these computers, first determine temperature rise, using Mach number, indicated air temperature, and .8 as recovery coefficient. (The .8 value will usually be shown; however, another value may be substituted.) This temperature rise must then be divided by .8 (or substitute) and multiplied by .62 (the recovery coefficient for this airplane). The free air temperature is colder than indicated by the result.

MACH NUMBER CORRECTION.

There is no correction to be applied to true Mach number to obtain indicated Mach number. Any reference to Mach number may be considered as indicated or true.

AIRSPEED CONVERSION.

An airspeed conversion chart (figure A1-4) is used to convert calibrated airspeed (CAS) to true airspeed (TAS) or true Mach number. Indicated airspeed (IAS) must be converted to CAS before entering the chart. Conversely, CAS and true Mach number may be determined when TAS is known. A temperature correction plot allows the required values to be determined for nonstandard day temperatures.

NOTE The temperature to be used is the actual free air temperature and not the indicated temperatures.

DATA AS OF: OCTOBER 1964

BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23, AND NAA)

ALTIMETER POSITION CORRECTION

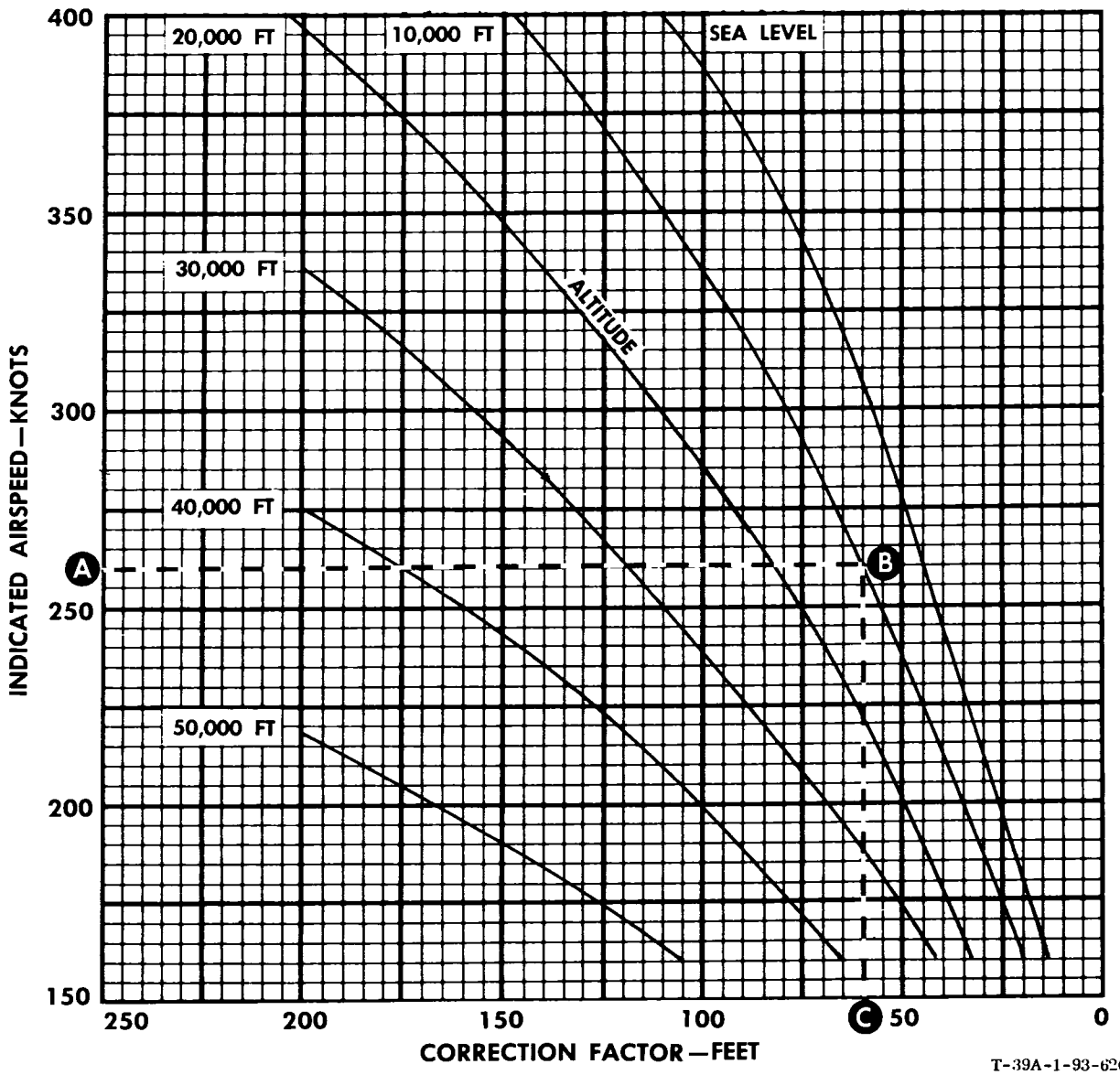
MODEL: T-39A & B

ENGINES: (2) J60-P-3 OR -3A

INDICATED PRESSURE ALTITUDE EQUALS CALIBRATED ALTITUDE PLUS CORRECTION FACTOR

FLAPS AND GEAR UP FOR ALL GROSS WEIGHTS

HOW TO USE CHART
At indicated airspeed (A) (260 knots IAS) for calibrated altitude (B) (10,000), fly indicated altitude (C) (60) feet higher than calibrated altitude.



T-39A-1-93-62C

Figure A1-1

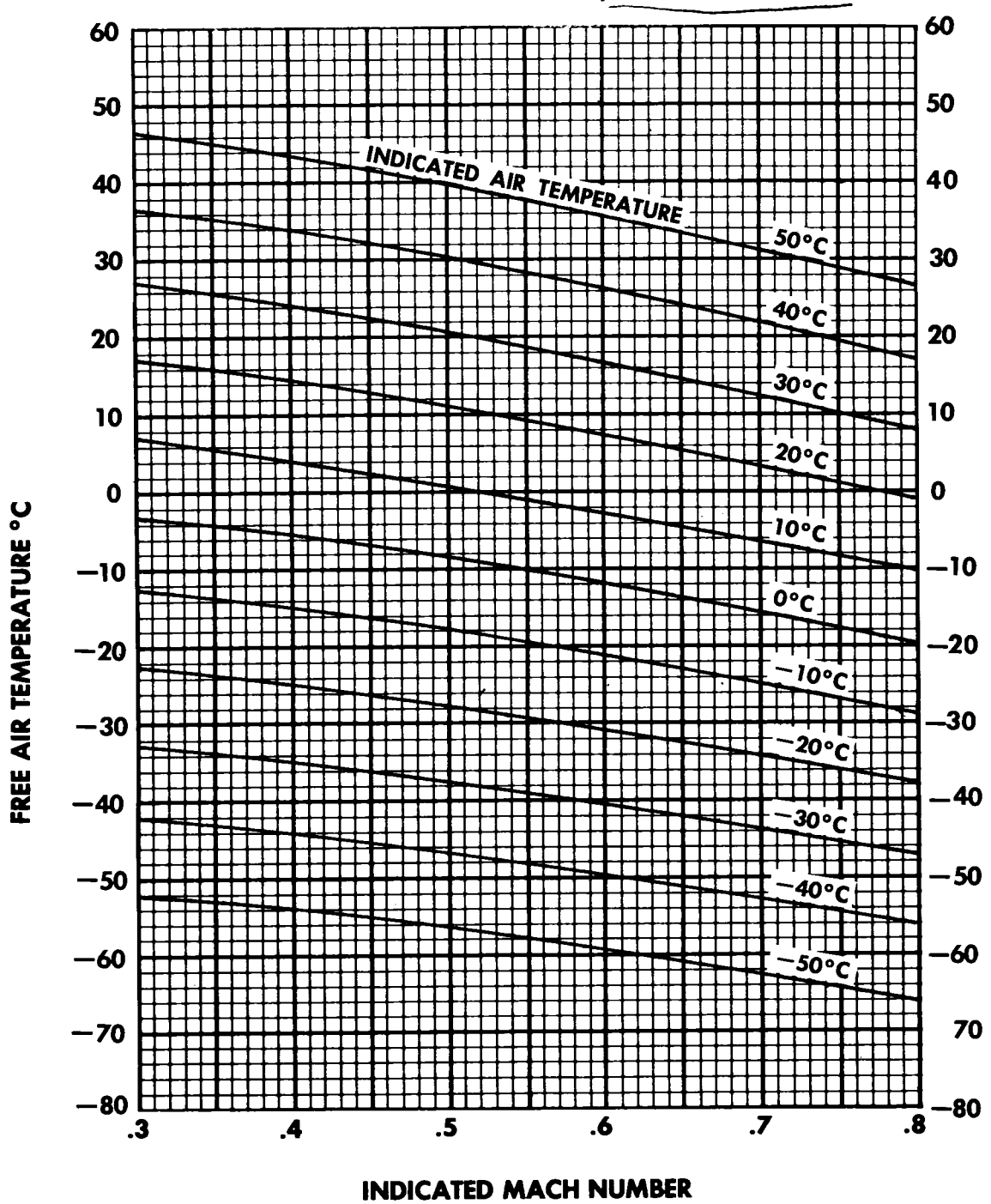
DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23, AND NAA)

FREE AIR TEMPERATURE CORRECTION

MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A

NOTE

Chart data based on ram-air recovery coefficient of .62.



39A-1-93-31C

Figure A1-2

STANDARD DAY TEMPERATURE

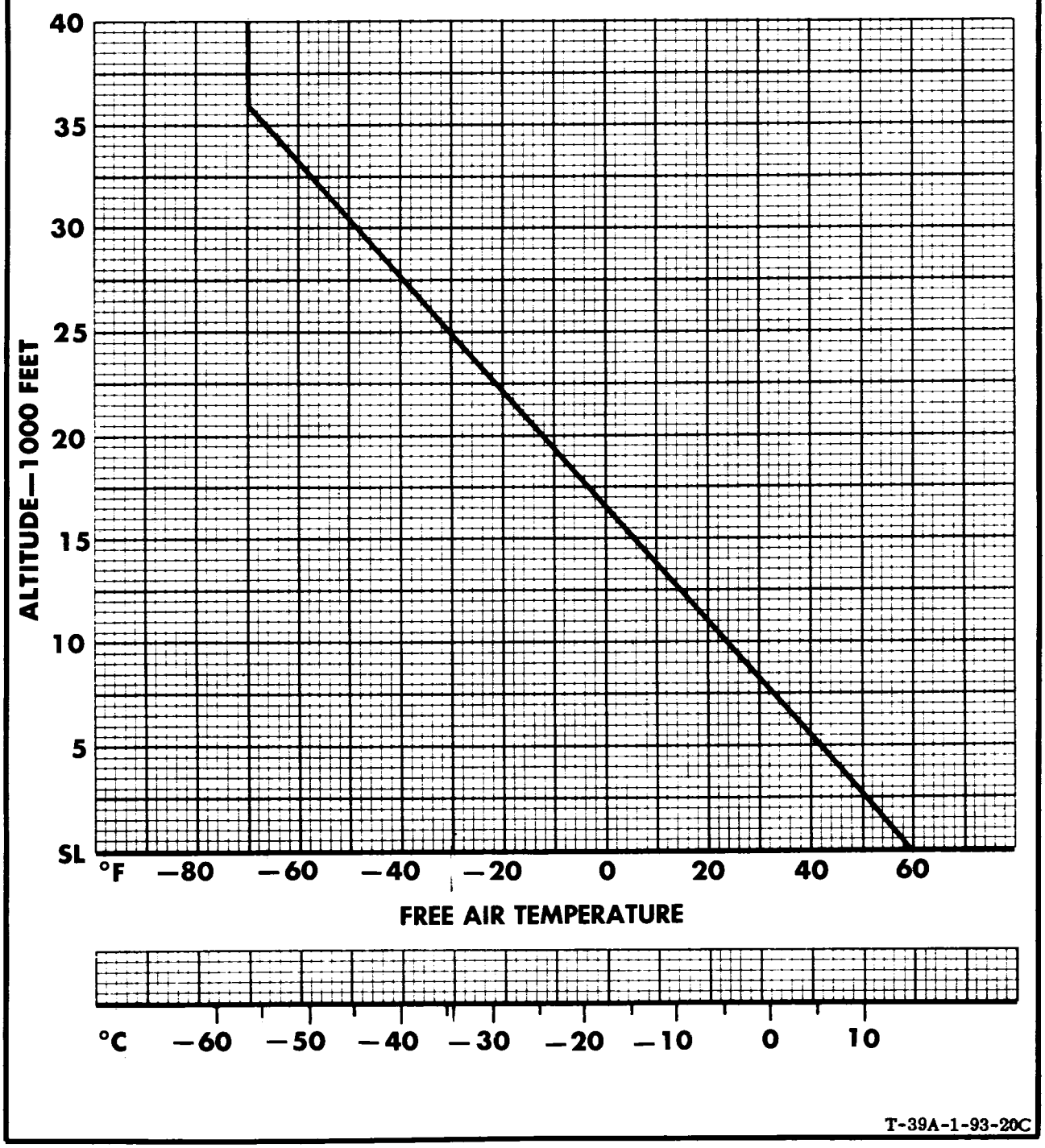
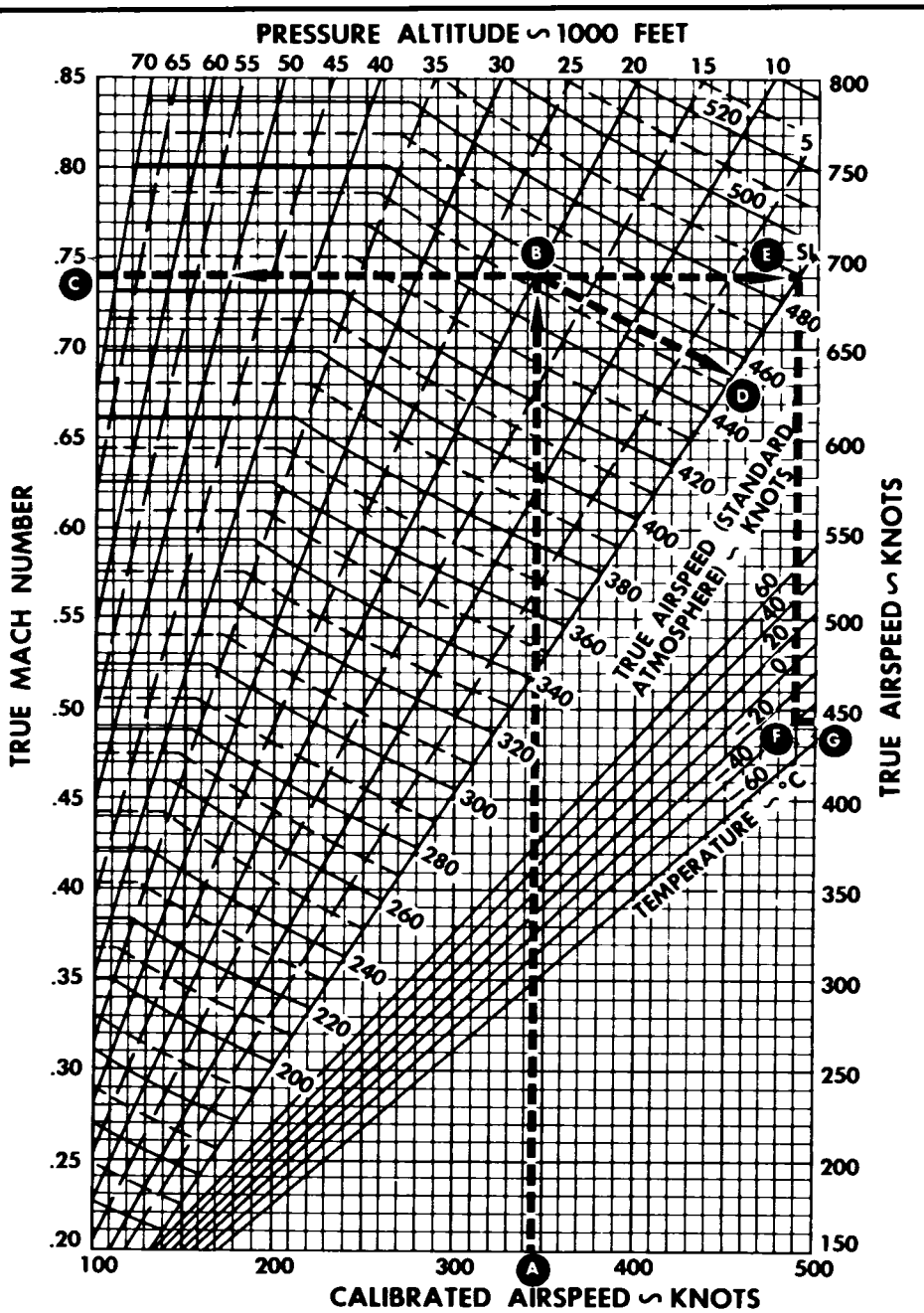


Figure A1-3

AIRSPEED CONVERSION DATA



HOW TO USE CHART

Enter with CAS (A), move vertically to altitude (B) to find true Mach number (C) and Standard Day true airspeed (D), move horizontally along true Mach number to sea-level altitude (E), and drop vertically to actual temperature (F) to find non-Standard Day true airspeed (G)

EXAMPLE

345 knots CAS at 20,000 feet is .74 true Mach number and 454 knots TAS on an ICAO Standard Day or 444 knots on a −40°C day.

39A-1-93-1D

Figure A1-4

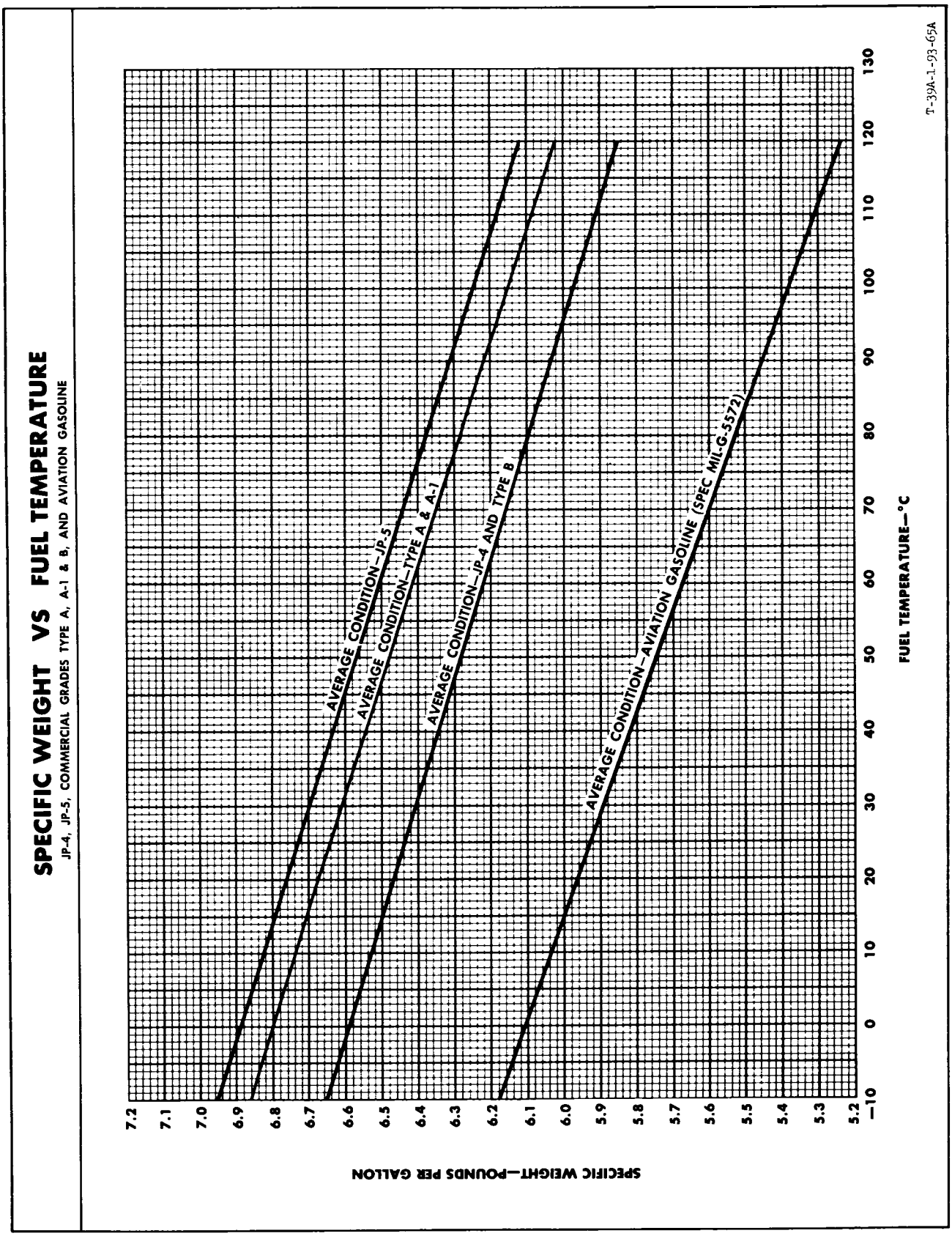

SPECIFIC WEIGHT VS FUEL TEMPERATURE
JP-4, JP-5, COMMERCIAL GRADES TYPE A, A-1 & B, AND AVIATION GASOLINE
T-39A-1-93-65A
AVERAGE CONDITION—JP-5
AVERAGE CONDITION—TYPE A & A-1
AVERAGE CONDITION—JP-4 AND TYPE B
AVERAGE CONDITION—AVIATION GASOLINE (SPEC MIL-G-5572)
SPECIFIC WEIGHT—POUNDS PER GALLON
7.2
7.1
7.0
6.9
6.8
6.7
6.6
6.5
6.4
6.3
6.2
6.1
6.0
5.9
5.8
5.7
5.6
5.5
5.4
5.3
5.2
—10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
FUEL TEMPERATURE—°C

Figure A1-5

NONSTANDARD DAY TEMPERATURE.

When the free air temperature is higher than standard (occurring on hot days), the airplane will perform as if it weighs more than it actually does. When the free air temperature is lower than standard, the airplane will perform as if it weighs less than it actually does. Where cruise is performed at the cruise ceiling (limited by Normal Rated Thrust) at temperature above standard, the altitude will be decreased because at any particular thrust setting, the thrust is decreased. If cruise is performed below the cruise ceiling, the maximum cruise thrust is not being used. Actually an excess of thrust is available on a Standard Day. The thrust loss due to an increase in ambient temperature has only the effect of requiring a higher cruise engine speed and a slightly higher specific fuel consumption. Use of an equivalent weight permits utilization of the Standard Day charts under nonstandard temperature conditions. Equivalent weight is obtained by applying a weight increment to actual airplane gross weight. The equivalent weight is used only to determine the nonstandard climb performance and cruise ceiling. For each 10°C rise in air temperature above Standard Day conditions, increase actual gross weight, as shown on the individual chart, before entering the climb chart. For each 10°C below Standard Day conditions, reduce actual gross weight, as shown on the individual chart, before entering the climb chart. Cruise performance is determined for the actual airplane gross weight.

Standard Day temperature throughout the altitude range of the airplane can be determined from the Standard Day temperature chart (figure A1-3).

FUEL SPECIFIC WEIGHT.

In precise mission planning, the specific fuel weight must be considered. This weight will vary from grade to grade, between fuels of the same grade (because of refining methods), and with temperature. All data given in this section is based on the use of JP-4 fuel. A chart (figure A1-5) shows the specific weight of average condition JP-4 for fuel temperatures from -10°C to 120°C. The same information is also presented for alternate and emergency fuels. To use the chart, determine the specific weight and temperature of a particular fuel. From a plot of this point on the chart, assume a variation with fuel temperature parallel to that of the average condition line for the grade of fuel being used.

NOTE The specific fuel consumption of the alternate and emergency fuels is the same as JP-4. A slight increase in range will be noticed, when fuels heavier than JP-4 are used, and a slight decrease in range will be noticed when fuels with a reduced weight per gallon are used.

PART 2–TAKE-OFF

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Cross-wind Chart	A2-3
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TAKE-OFF

TAKE-OFF PLANNING.

This part covers the information and charts to be used to obtain take-off speeds and distances. The terms used in the planning procedure are defined in the following paragraphs. Take-off performance is affected by a large number of variables, i.e., temperature, altitude, gross weight, and wind, as well as runway surface, use of brakes for directional control, and engine condition. Charts including these variables are provided for take-off ground run, climb out distance (one- and two-engine operation), critical field length, refusal speeds, and cross-wind take-off and landing. Increases in any of these variables except wind tend to increase take-off ground run to a point where, on a take-off in which normal techniques are used, the take-off may not be successfully made in the available runway length. The use of these charts is explained in the following paragraphs, and chase-through examples are provided where necessary.

RUNWAY DISTANCE MARKING SYSTEM.

The numbering and placement of runway distance markers reflects the distance remaining to the end of the runway in 1000-foot increments. These markers are placed alongside the runway, and the appropriate markers become the take-off ground run distance marker. In accordance with the marker system on a runway length in excess of the

1000-foot interval (10,500), one-half the length over the exact thousands of feet [1/2 (10,500 - 10,000)] must be added to the distances shown on the markers to determine the actual distance remaining; i.e., at marker No. 6, the distance remaining would be 6250 feet.

CRITICAL FIELD LENGTH.

Critical field length is the minimum permissible runway length to be available for take-off for any particular gross weight, temperature, and pressure altitude. An engine failure at decision speed, on a critical length runway, would require all remaining runway for abort or completion of single-engine take-off.

NOTE Refer to "Landing Distance - Ground Roll" in Part 6 of Appendix I for information on RCR.

The critical field length chart (figure A2-5) is used to determine the minimum field length required for take-off. In addition, the chart provides corrections for wind, runway slope, and RCR. The "chase through" indicates critical field length for the sample conditions.

Warning If critical field length exceeds the runway available, the take-off should not be attempted at that gross weight.

The maximum gross weight limited by critical field length may be found by reading into the chart with given atmospheric data and runway length.

NOTE When take-offs are made with a combination of high airport pressure altitude, high temperature, and high gross weight, 200-foot-per-minute climb gradients may not be obtained if an engine failure is experienced after take-off. A recommended gross weight limiting factor for a single-engine-out condition is included on the chart. When the outside air temperature is less than 60°F, there is no gross weight limiting factor.

The take-off speeds shown on the critical field length chart are for single-engine take-offs. These speeds differ slightly from two-engine take-off speeds, as airplane acceleration is faster with two-engine operation. It is necessary to adhere to this speed in order to obtain the performance shown on the chart.

Rotation speed, as obtained from the take-off ground run chart for two-engine operation, remains the same for single-engine take-off.

TAKE-OFF GROUND RUN—TWO ENGINES.

The take-off ground run chart (figure A2-6) is used to determine the ground run distance required from brake release to the point of take-off at the recommended take-off configuration of flaps-up. Use of the chart is explained by a chase-through sample problem.

NOTE When take-offs are made with a combination of high airport pressure altitude, high temperature, and high gross weight, 200-foot-per-minute climb gradients may not be obtained if an engine failure is experienced after take-off. A recommended gross weight limiting factor for a single-engine-out condition is included on the chart. When the outside air temperature is less than 60°F, there is no gross weight limiting factor.

REFUSAL SPEEDS.

Refusal speed is the maximum speed to which the airplane can accelerate and then stop in the remaining available runway. (See figure A2-7.) Refusal speed data is based on two-engine Military Thrust acceleration to refusal speed and then optimum braking to a stop with engines at Idle Thrust and speed brake closed. Use of the chart is explained by a chase-through sample problem.

NOTE Refer to "Landing Distance - Ground Roll" in Part 6 of Appendix I for information on RCR.

ACCELERATION CHECK CHART.

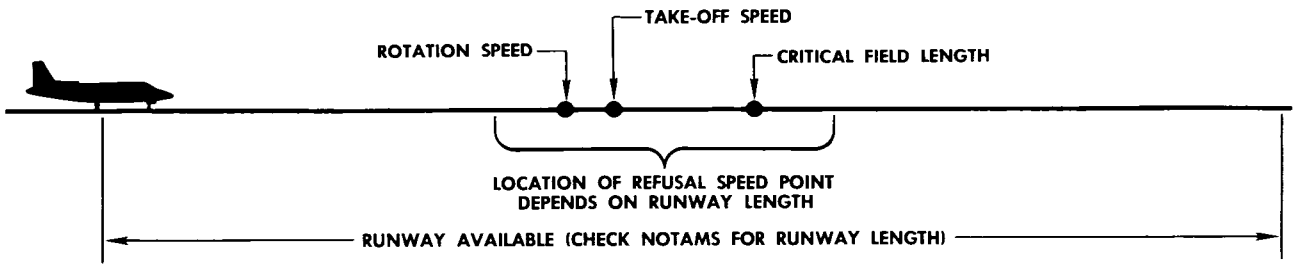
The acceleration check chart (figure A2-8) gives an indicated airspeed at any desired check-point distance, and conversely, the ground run distance required to accelerate to any desired indicated airspeed. An allowable airspeed tolerance of 5 knots IAS is the maximum speed deficiency that is acceptable at any check-point distance. If acceleration is deficient to the extent that the speed tolerance is exceeded at any check-point distance, a serious malfunction of the airplane is indicated and the take-off should be aborted even if excess runway is available. Use of the chart is explained by a chase-through sample problem.

CLIMB-OUT DISTANCE—TWO ENGINES.

The climb-out distance - two engines chart (figure A2-9) is used to determine the distance required to clear a 50-foot obstacle from take-off. This

TAKE-OFF COMPUTATION EXAMPLE

BASED ON A GIVEN AIRPLANE GROSS WEIGHT, PRESSURE ALTITUDE, AND TEMPERATURE



NOTE

- Refusal speed occurs at a precise spot on the runway for a specific take-off condition and runway available. Refusal speed may occur at any point within the range shown, dependent on the length of runway available.
- Decision speed for abort is refusal speed or rotation speed, whichever is less.

EXAMPLE (A)	
Gross weight	17,600 lb
Pressure altitude	2000 ft
Runway temperature	27°C
Runway length	5500 ft
Refusal speed	106 knots IAS
Rotation speed	114 knots IAS

Decision speed will be the REFUSAL SPEED of 106 knots IAS.

EXAMPLE (B)	
Gross weight	17,600 lb
Pressure altitude	2000 ft
Runway temperature	27°C
Runway length	7000 ft
Refusal speed	119 knots IAS
Rotation speed	114 knots IAS

Decision speed will be the ROTATION SPEED of 114 knots IAS.

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Figure A2-1

distance is based on the airplane climbing to the 50-foot obstacle, using the correct take-off speed at take-off, and arriving at the obstacle at the obstacle limited climb-out speed. A chase-through example shows the proper use of this chart, and how corrections for temperature, gross weight, and wind are applied. Total distance to clear a 50-foot obstacle is obtained by adding the ground run distance and the air distance.

CLIMB-OUT DISTANCE—ONE ENGINE.

The climb-out distance - one engine chart (figure A2-10) is used during mission planning to determine the distance required to clear a 50-foot obstacle in case of an engine failure. Since take-off should always occur at or before critical field length, total distance from brake release to clear a 50-foot obstacle, with one engine failed, may be determined by adding the climb-out distance - one engine to the critical field length.

MILITARY THRUST SETTING—TAKE-OFF.

The take-off Military Thrust setting chart (figure A2-3) shows the exhaust total pressure (P_{t5}) desired for take-off for any given ambient temperature and pressure altitude.

CROSS-WIND CHART.

The cross-wind chart (figure A2-4) is used to determine the head- or tail-wind component in order to compute the take-off and landing distances. It is also used to determine the cross-wind component and whether a safe take-off or landing can be made. The chart permits determining the rotation and nose wheel touchdown speeds when limited by cross wind.

NOTE Figure A2-4 contains a sample problem for determining head- or tail-wind and

cross-wind components and the rotation and nose wheel touchdown speeds.

For the purpose of determining the cross-wind component, and whether a safe take-off or landing can be made, the chart is divided into two areas (recommended and not recommended). The cross-wind base line is based on the use of aerodynamic steering (rudder) only and does not include the effects of nose wheel steering or differential braking.

Rudder effectiveness varies directly with speed. Considering this fact, assume full rudder is required to maintain airplane heading aligned with runway heading at rotation. It can be seen, then, that at airplane lift-off speed, there will be virtually no additional rudder available to obtain a crab condition necessary to maintain flight path in line with the runway. Also, if full rudder is required in a sideslip approach to landing, full rudder will not be adequate to maintain directional control at the lower speeds encountered during flare and touchdown. The chart considers these requirements and therefore includes rotation and nose wheel touchdown speeds which must be observed when limited by cross wind.

The rotation speed used should not be less than the normal precomputed rotation speed as obtained from the take-off ground run chart.

Warning As the chart shows, certain cross-wind conditions result in a component which will not permit safe take-off or landing no matter what the increase in speed.

- Increases in rotation or nose wheel touchdown speed will obviously mean take-off or landing rolls in excess of normal. If speed increase required is excessive, the available runway length could be exceeded; consequently, take-off should not be made (or a suitable alternate landing field used).

The chart permits determining the minimum rotation and nose wheel touchdown speeds when limited by cross wind.

TAKE-OFF AND LANDING DATA CARD

Before takeoff, the pilot will compute all data required to complete the Take-off and Landing Data Card. A reproduction of this card appears in the applicable abbreviated checklist. The card should be filled out so that the information the card provides will be available as needed. The required data is computed from the appropriate charts in this appendix. Interpretation of the data entered on the card is subject to a number of variables with which the pilot should be familiar. For example, rapid changes in weather may produce marked variations between precomputed performance and actual performance. Such factors as braking during take-off, runway surface conditions, etc, can seriously affect the performance which is precomputed and entered on the card. However, the card is very useful as a general guide to expected airplane performance and will contribute substantially to flight safety when properly used. This example is provided as a guide for completion of the card.

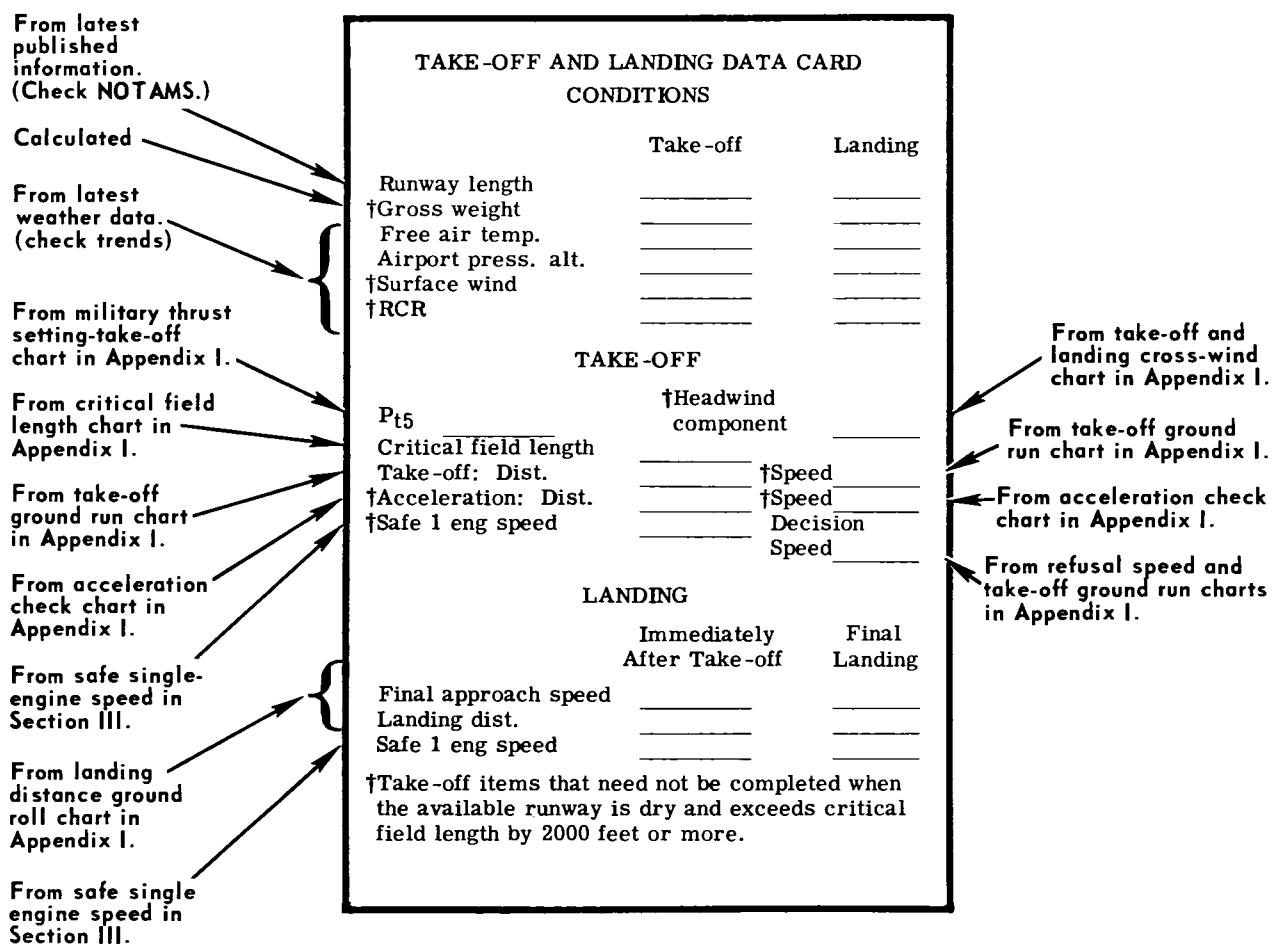


Figure A2-2

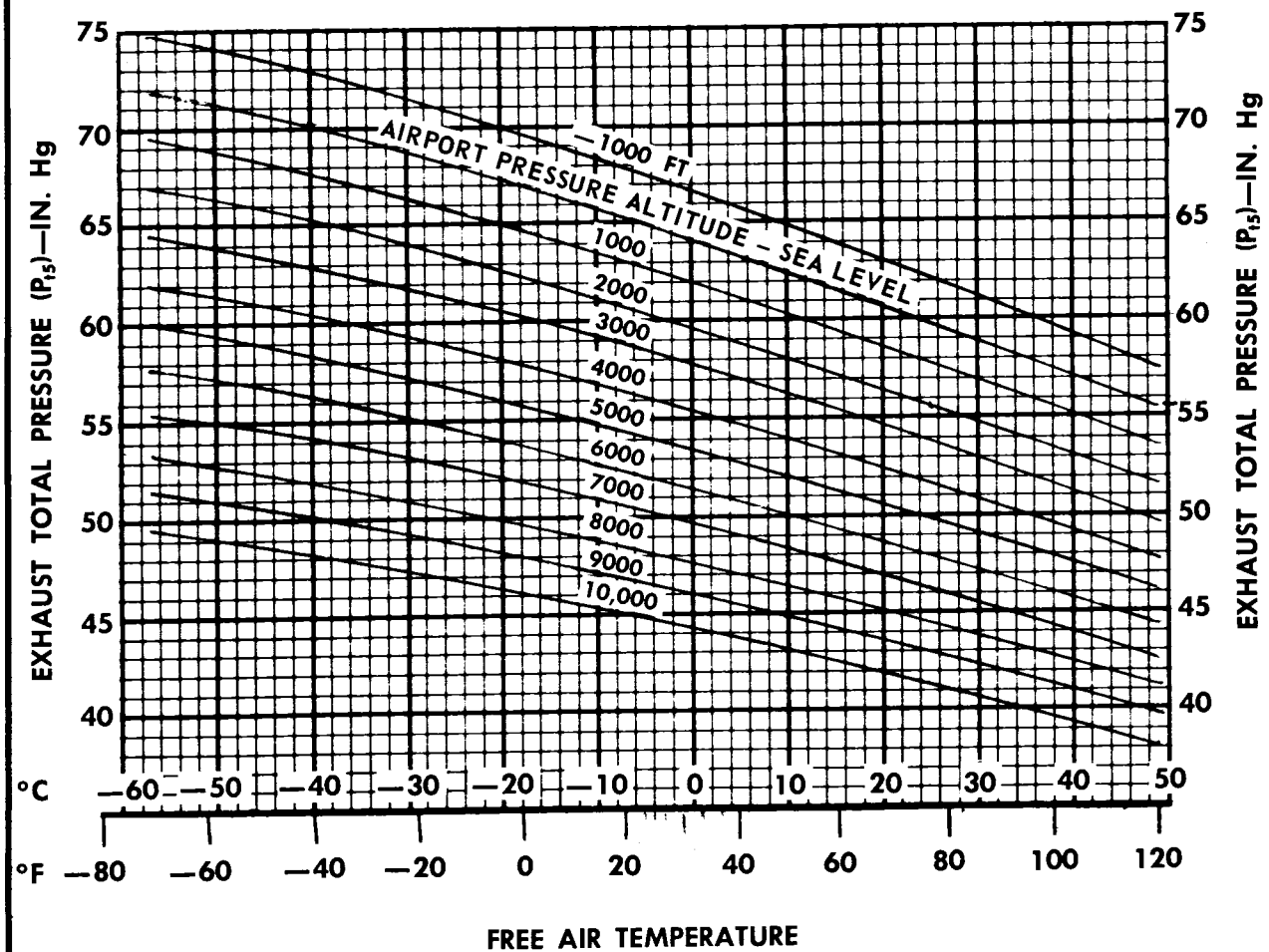
DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23, AND NAA)

MILITARY THRUST SETTING— TAKE-OFF

MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4

NOTE

- Do not use temperature gage in the cockpit for obtaining free air temperature on the ground.
- Advance throttles to correct P_{15} setting for take-off before turning engine inlet anti-icing on. (when required).



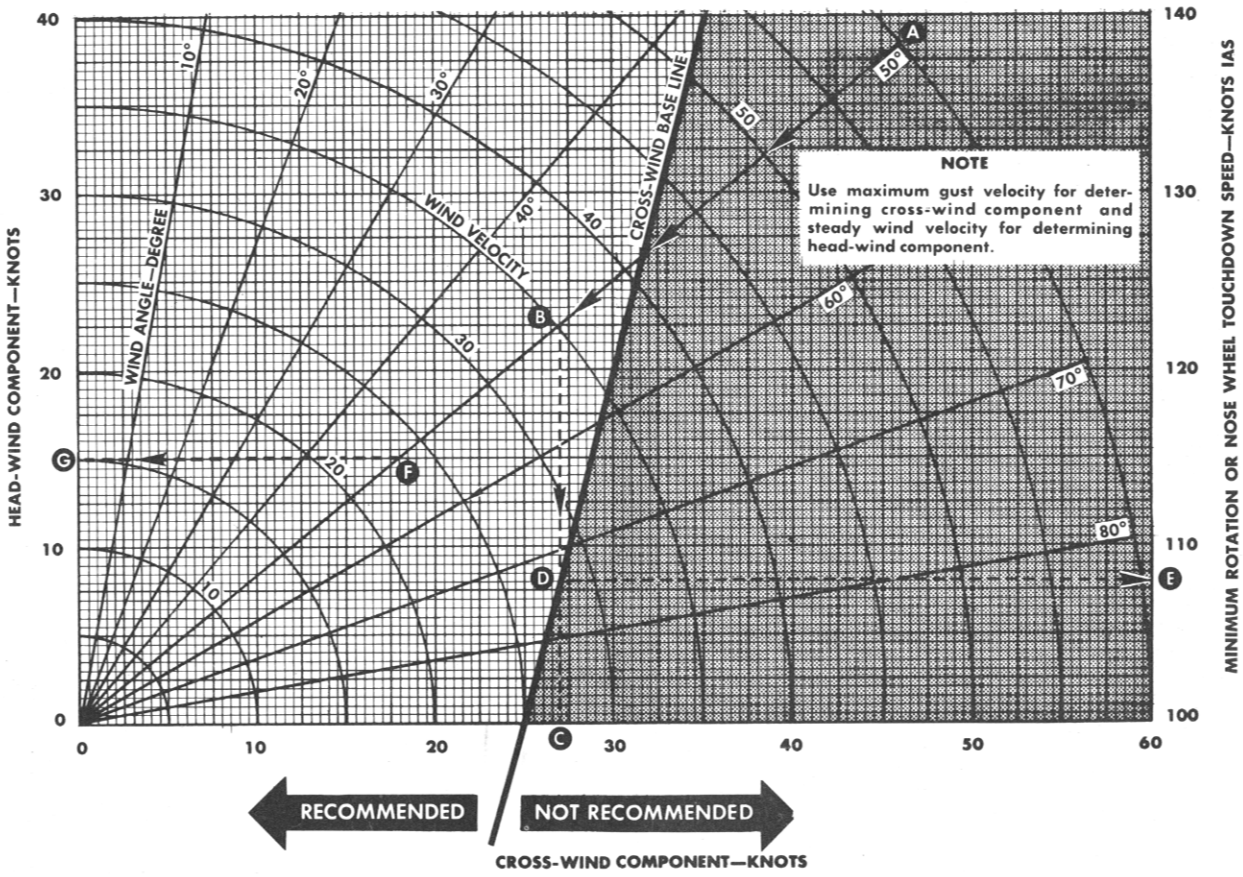
39A-1-93-40E

Figure A2-3

DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST (USAF FTC-TDR-64-23, AND NAA)

TAKE-OFF AND LANDING CROSS-WIND CHART

MODEL: T-39A & B
ENGINES: (2) J60-P-3 OR -3A



NOTE

1. Maximum nose wheel touchdown speed is 120 knots IAS. NEW
2. This information does not apply to single-engine operation.
3. Minimum speed for rudder effectiveness is 60 knots. NEW
4. To obtain tail-wind component, enter chart with direction of wind taken from reciprocal of runway heading.

EXAMPLE

- (A) is cross-wind direction from runway heading (50 degrees).
- (B) is maximum gust velocity (35 knots).
- (C) is cross-wind component (27 knots).
- (D) Proceed vertically until cross-wind base line is contacted.
- (E) Proceed horizontally to right to determine minimum rotation or nose wheel touchdown speed (108 knots IAS).
- (F) is steady wind velocity (23 knots).
- (G) is head-wind component (15 knots).

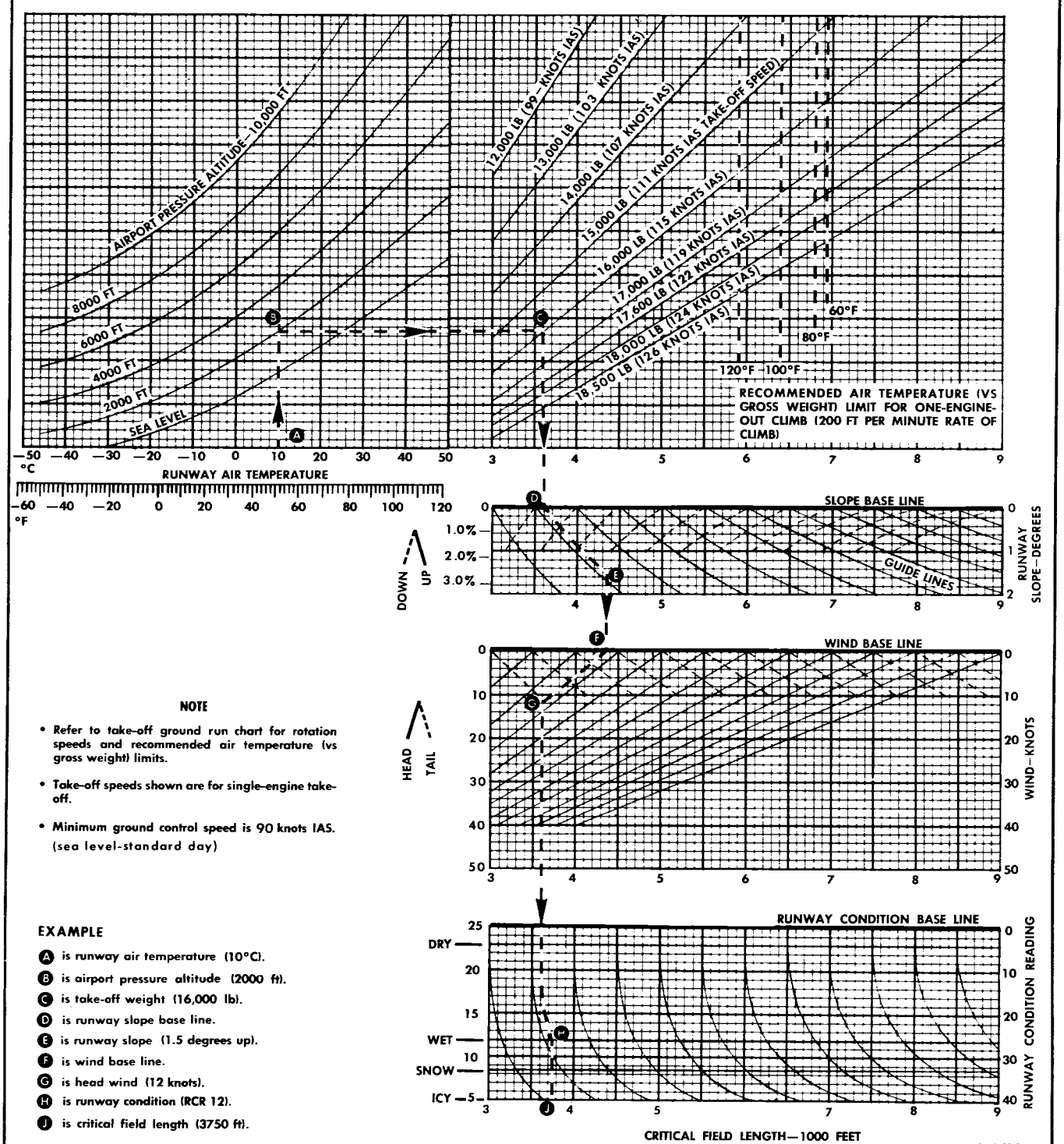
39A-1-93-3G

Figure A2-4

DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23, AND NAA)

CRITICAL FIELD LENGTH
FLAPS UP

MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4



NOTE

- Refer to take-off ground run chart for rotation speeds and recommended air temperature (vs gross weight) limits.
- Take-off speeds shown are for single-engine take-off.
- Minimum ground control speed is 90 knots IAS. (sea level-standard day)

EXAMPLE

- (A) is runway air temperature (10°C).
- (B) is airport pressure altitude (2000 ft).
- (C) is take-off weight (16,000 lb).
- (D) is runway slope base line.
- (E) is runway slope (1.5 degrees up).
- (F) is wind base line.
- (G) is head wind (12 knots).
- (H) is runway condition (RCR 12).
- (J) is critical field length (3750 ft).

Figure A2-5

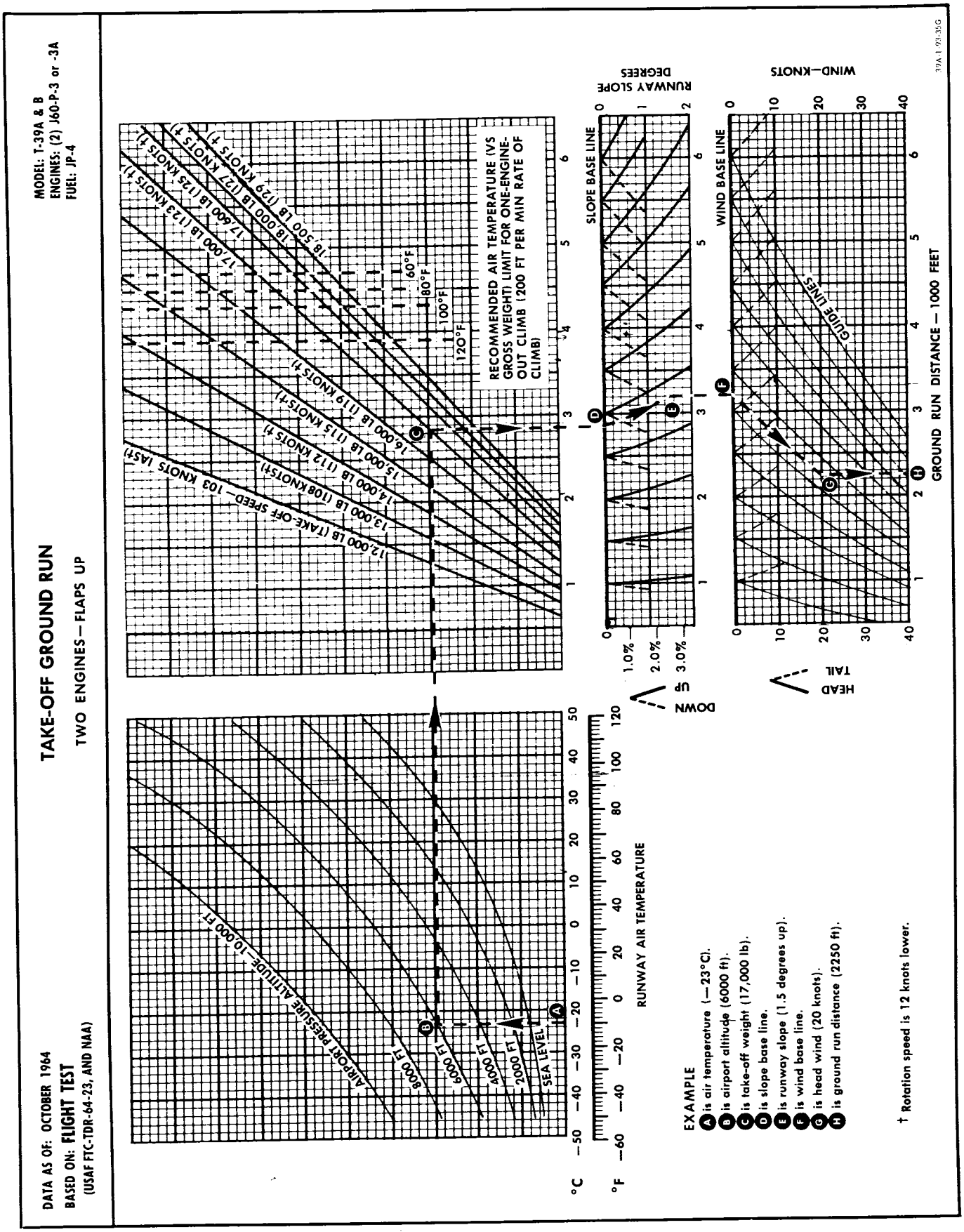

TAKE-OFF GROUND RUN
TWO ENGINES—FLAPS UP
DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23, AND NAA)
MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4
RECOMMENDED AIR TEMPERATURE (VS GROSS WEIGHT) LIMIT FOR ONE-ENGINE-OUT CLIMB (200 FT PER MIN RATE OF CLIMB)
12,000 LB (TAKE-OFF SPEED—103 KNOTS IAS†)
13,000 LB (108 KNOTS†)
14,000 LB (112 KNOTS†)
15,000 LB (115 KNOTS†)
16,000 LB (119 KNOTS†)
17,000 LB (123 KNOTS†)
17,600 LB (125 KNOTS†)
18,000 LB (127 KNOTS†)
18,500 LB (129 KNOTS†)
60°F
80°F
100°F
120°F
AIRPORT PRESSURE ALTITUDE—10,000 FT
8000 FT
6000 FT
4000 FT
2000 FT
SEA LEVEL
°C
°F
RUNWAY AIR TEMPERATURE
SLOPE BASE LINE
RUNWAY SLOPE DEGREES
DOWN
UP
1.0%
2.0%
3.0%
WIND BASE LINE
WIND—KNOTS
HEAD
TAIL
GUIDE LINES
GROUND RUN DISTANCE—1000 FEET
EXAMPLE
(A) is air temperature (—23°C).
(B) is airport altitude (6000 ft).
(C) is take-off weight (17,000 lb).
(D) is slope base line.
(E) is runway slope (1.5 degrees up).
(F) is wind base line.
(G) is head wind (20 knots).
(H) is ground run distance (2250 ft).
† Rotation speed is 12 knots lower.

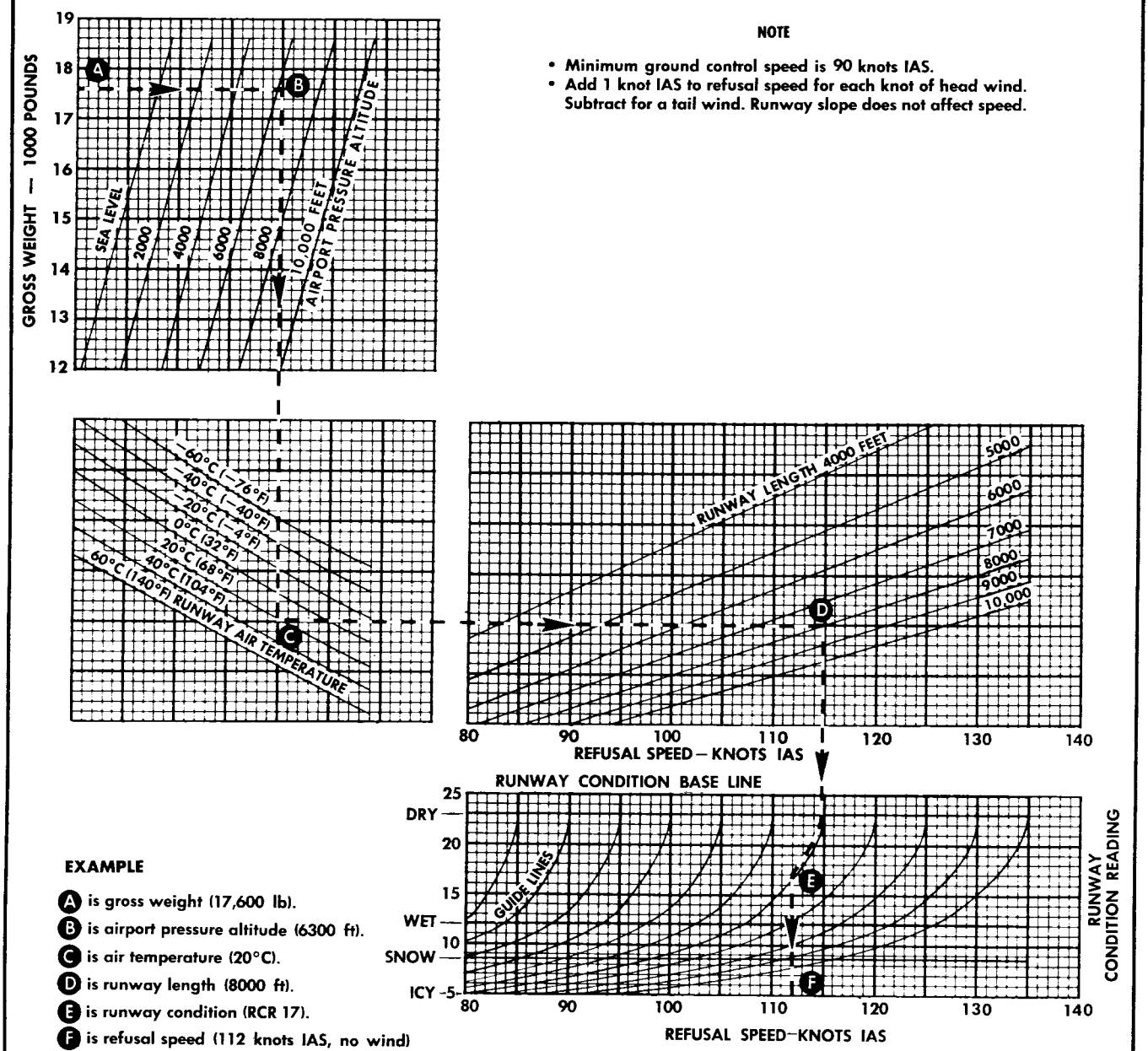
Figure A2-6

DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23, AND NAA)

REFUSAL SPEEDS

MILITARY THRUST—FLAPS UP

MODEL: T-39A & B
ENGINES: (2) J-60-P-3 or -3A
FUEL: JP-4



NOTE

- Minimum ground control speed is 90 knots IAS.
- Add 1 knot IAS to refusal speed for each knot of head wind. Subtract for a tail wind. Runway slope does not affect speed.

EXAMPLE

- (A) is gross weight (17,600 lb).
- (B) is airport pressure altitude (6300 ft).
- (C) is air temperature (20°C).
- (D) is runway length (8000 ft).
- (E) is runway condition (RCR 17).
- (F) is refusal speed (112 knots IAS, no wind)

39A-1-93-53G

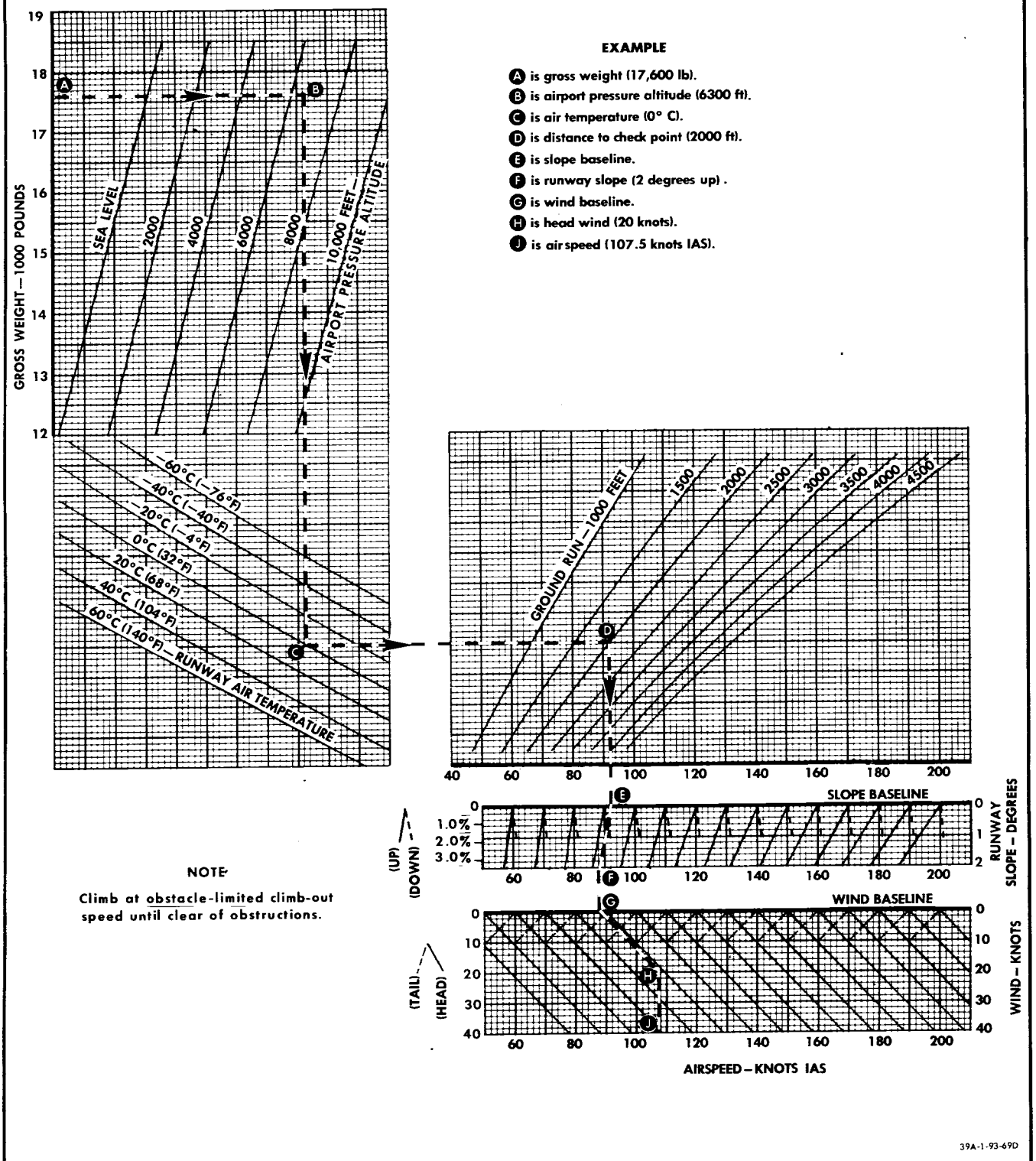
Figure A2-7

DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23, AND NAA)

ACCELERATION CHECK

TWO ENGINES—FLAPS UP

MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4



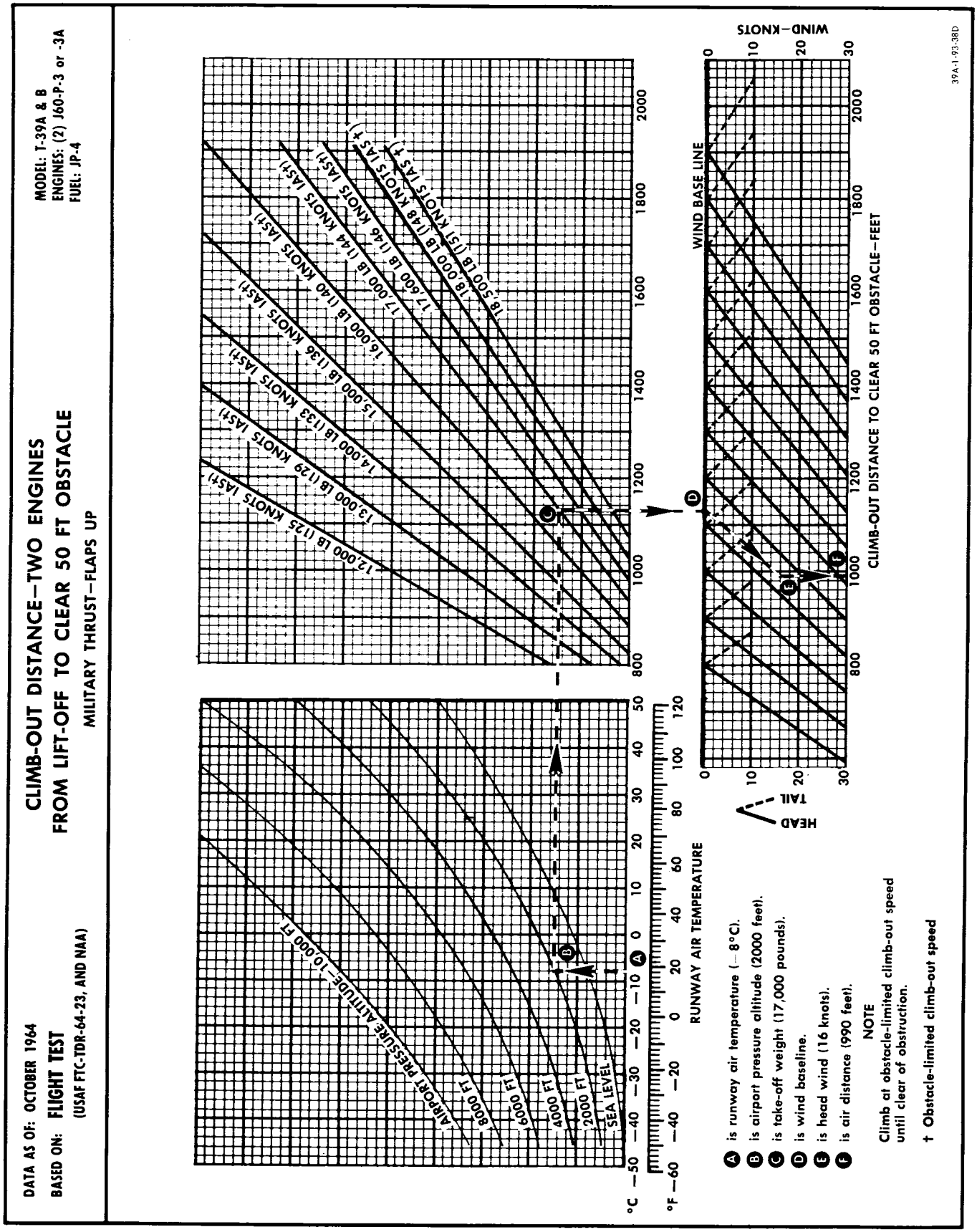
EXAMPLE

- Ⓐ is gross weight (17,600 lb).
- Ⓑ is airport pressure altitude (6300 ft).
- Ⓒ is air temperature (0° C).
- Ⓓ is distance to check point (2000 ft).
- Ⓔ is slope baseline.
- Ⓕ is runway slope (2 degrees up).
- Ⓖ is wind baseline.
- Ⓗ is head wind (20 knots).
- Ⓙ is airspeed (107.5 knots IAS).

NOTE

Climb at obstacle-limited climb-out speed until clear of obstructions.

Figure A2-8



Ⓐ is runway air temperature (—8°C).
Ⓑ is airport pressure altitude (2000 feet).
Ⓒ is take-off weight (17,000 pounds).
Ⓓ is wind baseline.
Ⓔ is head wind (16 knots).
Ⓕ is air distance (990 feet).

NOTE

Climb at obstacle-limited climb-out speed until clear of obstruction.

† Obstacle-limited climb-out speed

Figure A2-9

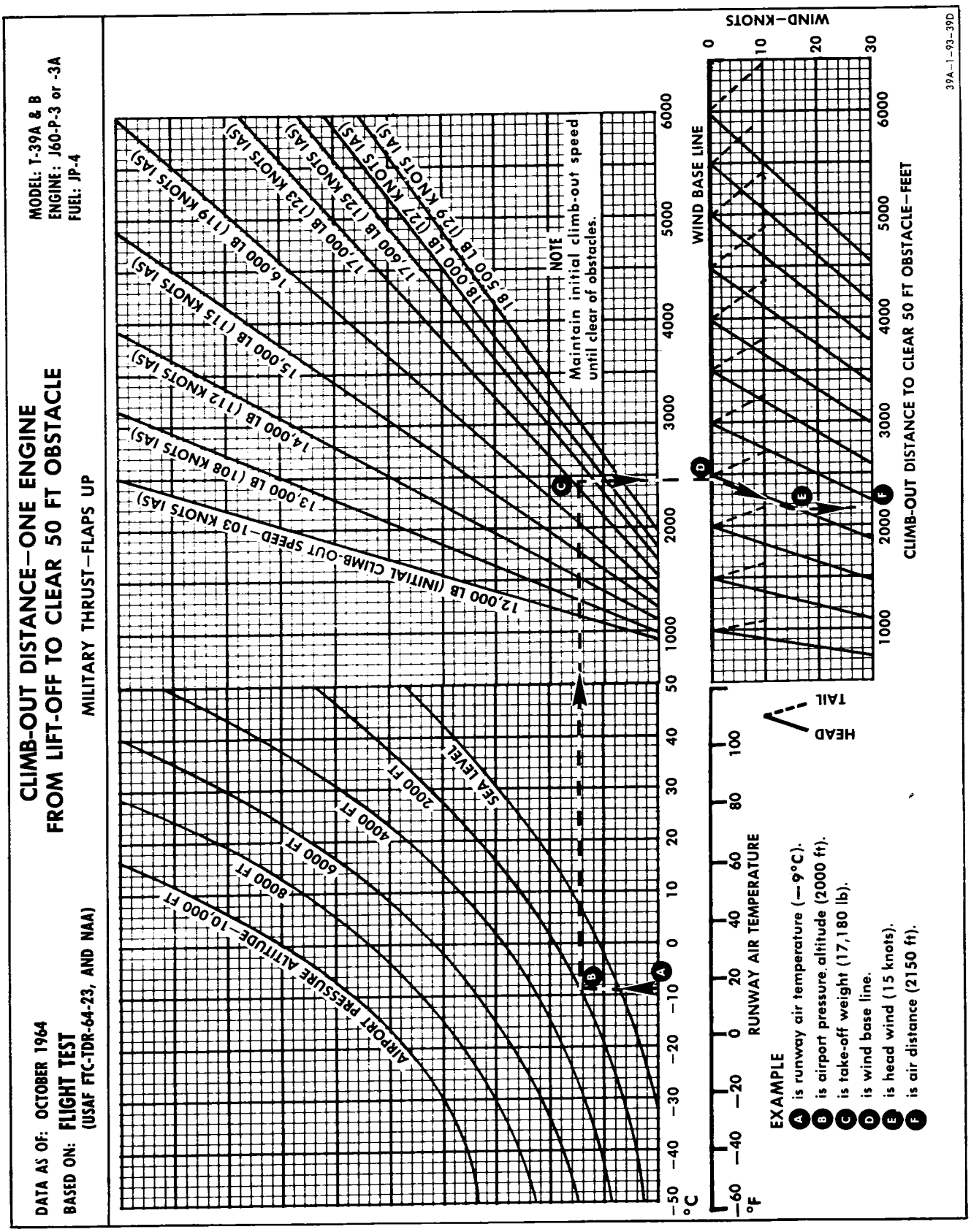

CLIMB-OUT DISTANCE—ONE ENGINE
FROM LIFT-OFF TO CLEAR 50 FT OBSTACLE
MILITARY THRUST—FLAPS UP
DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23, AND NAA)
MODEL: T-39A & B
ENGINE: J60-P-3 or -3A
FUEL: JP-4
AIRPORT PRESSURE ALTITUDE—10,000 FT
8000 FT
6000 FT
4000 FT
2000 FT
SEA LEVEL
12,000 LB (INITIAL CLIMB-OUT SPEED—103 KNOTS IAS)
13,000 LB (108 KNOTS IAS)
14,000 LB (112 KNOTS IAS)
15,000 LB (115 KNOTS IAS)
16,000 LB (119 KNOTS IAS)
17,000 LB (123 KNOTS IAS)
17,600 LB (125 KNOTS IAS)
18,000 LB (127 KNOTS IAS)
18,500 LB (129 KNOTS IAS)
NOTE
Maintain initial climb-out speed until clear of obstacles.
RUNWAY AIR TEMPERATURE
°C
°F
WIND BASE LINE
WIND—KNOTS
HEAD
TAIL
CLIMB-OUT DISTANCE TO CLEAR 50 FT OBSTACLE—FEET
EXAMPLE
A is runway air temperature (—9°C).
B is airport pressure altitude (2000 ft).
C is take-off weight (17,180 lb).
D is wind base line.
E is head wind (15 knots).
F is air distance (2150 ft).
39A-1-93-39D

Figure A2-10

PART 3–CLIMB

TABLE OF CONTENTS

Titles CAPITALIZED denote charts.

TITLE	PAGE
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Normal Rated Thrust Settings - In-flight	A3-2
Sample Problem (Figure A3-1)	A3-2
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MILITARY THRUST CLIMB - ONE ENGINE	A3-4
NORMAL RATED THRUST CLIMB - TWO ENGINES	A3-5
CLIMB THRUST SETTINGS - TABULAR	A3-6
MILITARY THRUST SETTINGS - IN-FLIGHT	A3-7
NORMAL RATED THRUST SETTINGS - IN-FLIGHT	A3-8

CLIMB

DESCRIPTION.

Climb charts, based on constant-speed climb, are given for Military and Normal Rated Thrust. Time and distance are plotted against gross weight, with guide lines to show the reduction in gross weight during climb due to the fuel used. Service ceiling (100 fpm) is superimposed on the graph.

To approximate gross weight at start of climb, consider that 380 pounds of fuel will be used for start, taxi, take-off, and acceleration to climb speed.

To obtain climb data, enter the applicable climb chart at the gross weight and altitude at start of climb. Note the time and distance at this point. From this initial altitude point, trace a curve parallel to the guide lines until it intersects the desired altitude at end of climb. Note the time, distance, and gross weight at this intersection. The difference between the initial and final time is the time required to climb. The difference between initial and final values for distance and for gross weight gives, respectively, the distance traveled and the fuel used to climb. Since time and distance are zero at sea level, the time required and distance traveled may be read directly for climbs starting at sea level. Fuel used, however, must still be determined by the difference in gross weights. The effect of temperature on time, fuel, and distance to climb is accounted for by using a corrected gross weight at start of climb (increased at temperatures above standard, decreased at temperatures below standard). To make the temperature correction more realistic, a mean deviation from standard temperature should be used rather than the sea-level deviation. This can be obtained by noting the nonstandard day temperatures throughout the climb, obtaining the difference from the corresponding Standard Day temperatures, and using the average of these obtained differences as the temperature to be used when applying the correction.

NOTE Adjustments to gross weight for temperatures other than standard are minor and need only be applied for long-range or precise mission planning.

MILITARY THRUST SETTINGS—IN-FLIGHT.

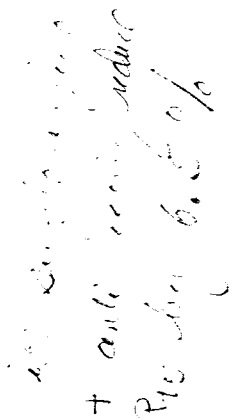
The in-flight Military Thrust settings chart (figure A3-5) shows the exhaust total pressure (P_{t5}) desired for Military Thrust in flight for any indicated air temperature and pressure altitude. When operating engine inlet anti-icing, reduce the P_{t5} by 5 percent. For single-engine operation, reduce the P_{t5} by 1.5 percent. These reductions are additive if both conditions occur at the same time.

NORMAL RATED THRUST SETTINGS—IN-FLIGHT.

The in-flight Normal Rated Thrust settings chart (figure A3-6) shows the exhaust total pressure (P_{t5}) desired for Normal Rated Thrust in flight for any indicated air temperature and pressure altitude. When operating engine inlet anti-icing, reduce the P_{t5} by 5 percent. For single-engine operation, reduce the P_{t5} by 1.5 percent. These reductions are additive if both conditions occur at the same time.

SAMPLE PROBLEM (FIGURE A3-1).

A.	Gross weight (start of climb)	17,000 lb
B.	Corrected gross weight (mean temperature deviation -10°C, 17,000 lb minus 1300 lb)	15,700 lb
C.	Initial altitude	2000 ft
D.	Initial distance	2 naut mi
E.	Initial time	1 min
F.	Final altitude	30,000 ft
G.	Final distance	57 naut mi
H.	Final time	10 min
J.	Final corrected gross weight	15,100 lb
	Fuel used (B minus J)	600 lb
	Actual gross weight (at final altitude; A minus fuel used)	16,400 lb
	Distance traveled (G minus D)	55 naut mi
	Time to climb (H minus E)	9 min



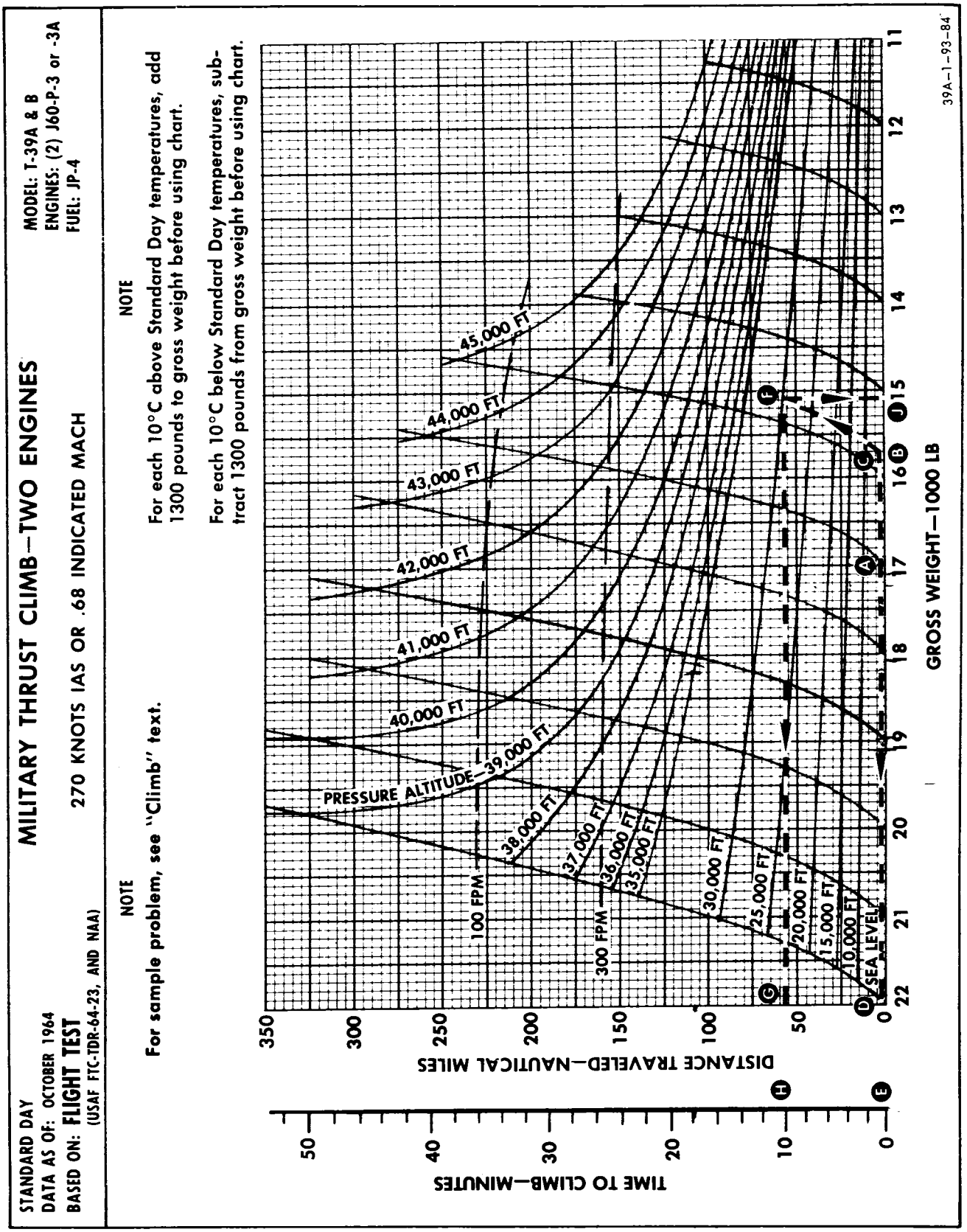

MILITARY THRUST CLIMB—TWO ENGINES
STANDARD DAY
DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23, AND NAA)
MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4
270 KNOTS IAS OR .68 INDICATED MACH
NOTE
For sample problem, see "Climb" text.
NOTE
For each 10°C above Standard Day temperatures, add 1300 pounds to gross weight before using chart.
For each 10°C below Standard Day temperatures, subtract 1300 pounds from gross weight before using chart.
PRESSURE ALTITUDE—39,000 FT
45,000 FT
44,000 FT
43,000 FT
42,000 FT
41,000 FT
40,000 FT
38,000 FT
37,000 FT
36,000 FT
35,000 FT
30,000 FT
25,000 FT
20,000 FT
15,000 FT
10,000 FT
SEA LEVEL
100 FPM
300 FPM
TIME TO CLIMB—MINUTES
DISTANCE TRAVELED—NAUTICAL MILES
GROSS WEIGHT—1000 LB
39A-1-93-84

Figure A3-1

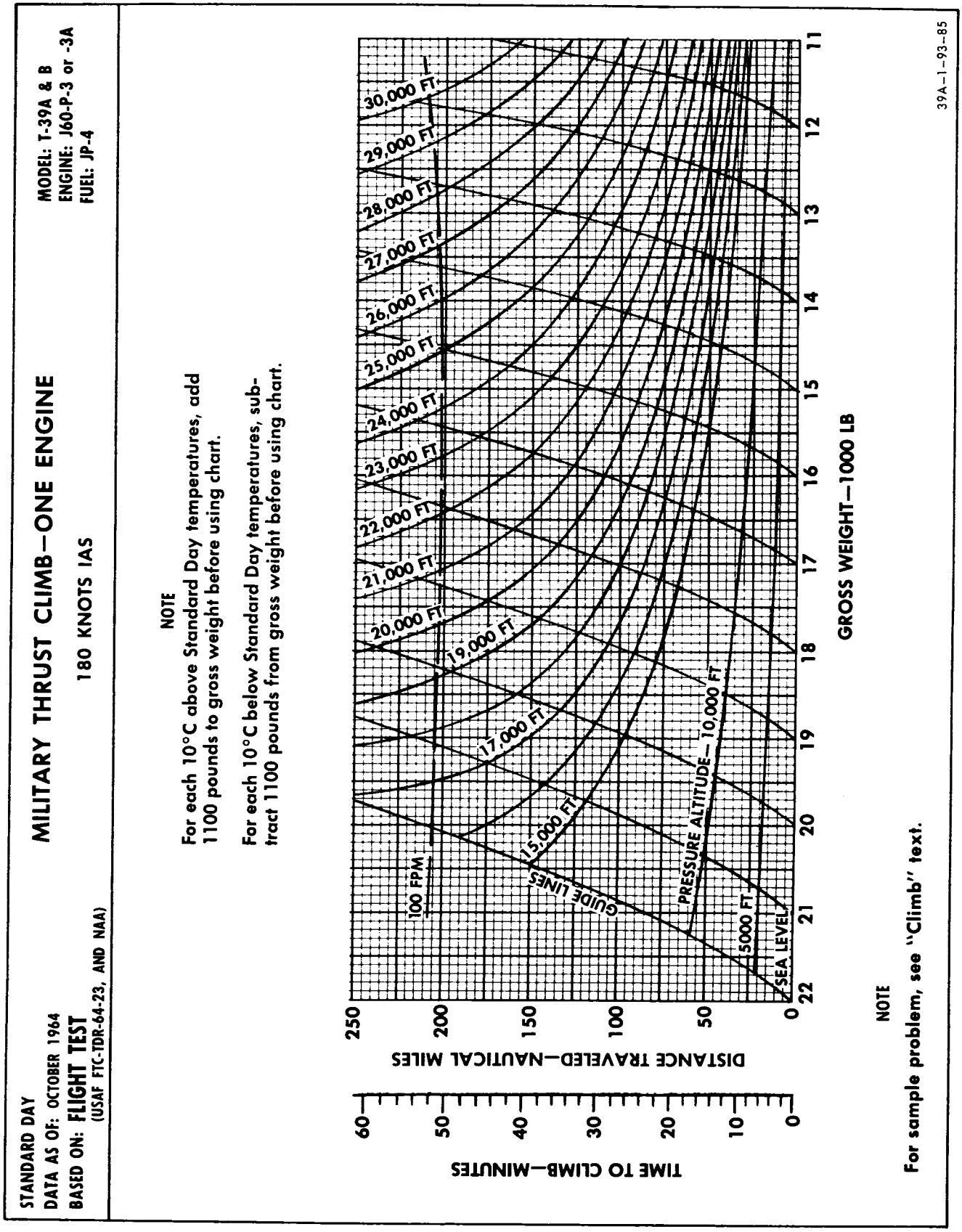

MILITARY THRUST CLIMB—ONE ENGINE
180 KNOTS IAS
STANDARD DAY
DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23, AND NAA)
MODEL: T-39A & B
ENGINE: J60-P-3 or -3A
FUEL: JP-4
NOTE
For each 10°C above Standard Day temperatures, add 1100 pounds to gross weight before using chart.
For each 10°C below Standard Day temperatures, subtract 1100 pounds from gross weight before using chart.
30,000 FT
29,000 FT
28,000 FT
27,000 FT
26,000 FT
25,000 FT
24,000 FT
23,000 FT
22,000 FT
21,000 FT
20,000 FT
19,000 FT
17,000 FT
15,000 FT
GUIDE LINES
PRESSURE ALTITUDE— 10,000 FT
5000 FT
SEA LEVEL
100 FPM
TIME TO CLIMB—MINUTES
DISTANCE TRAVELED—NAUTICAL MILES
GROSS WEIGHT—1000 LB
NOTE
For sample problem, see "Climb" text.
39A-1-93-85

Figure A3-2

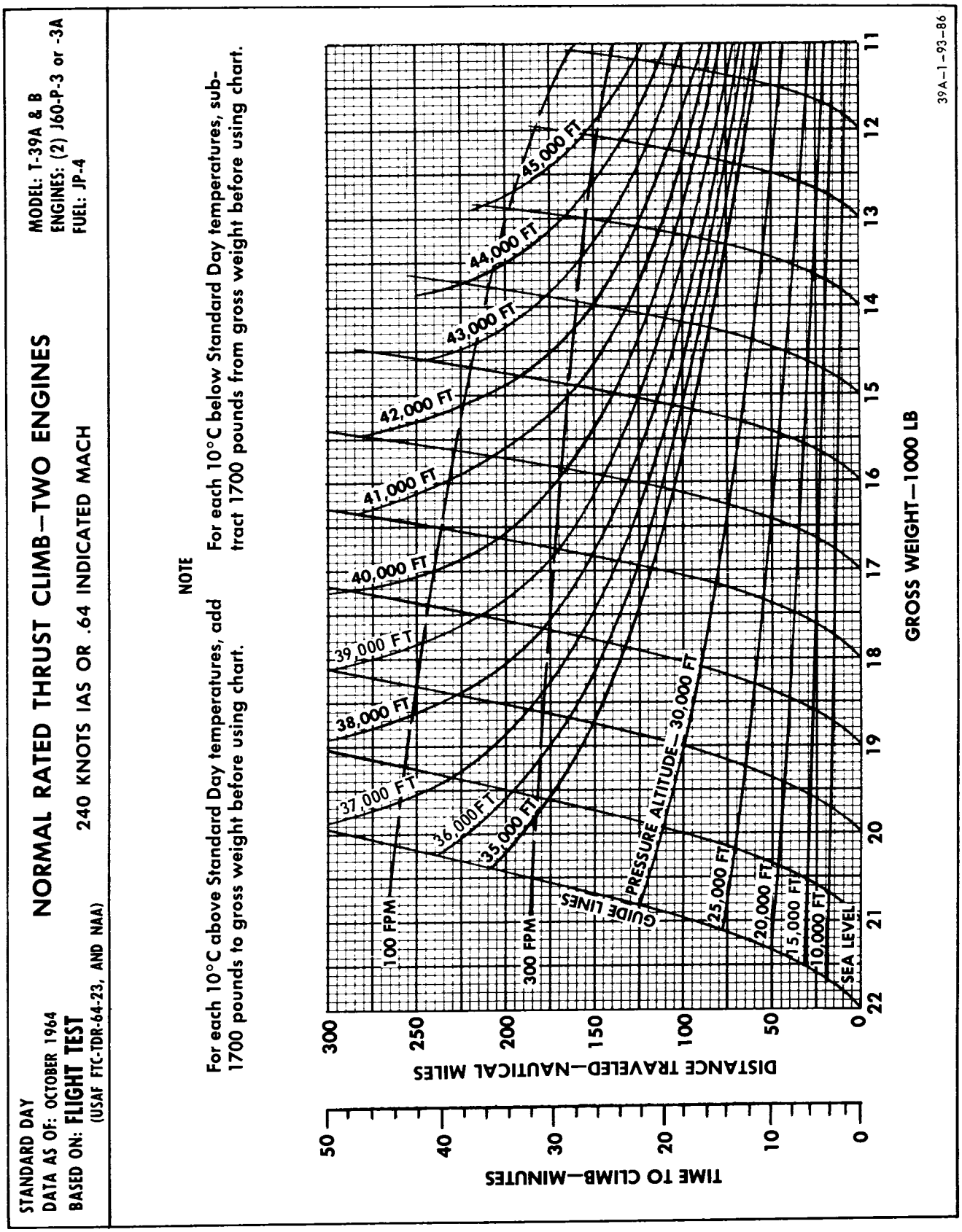
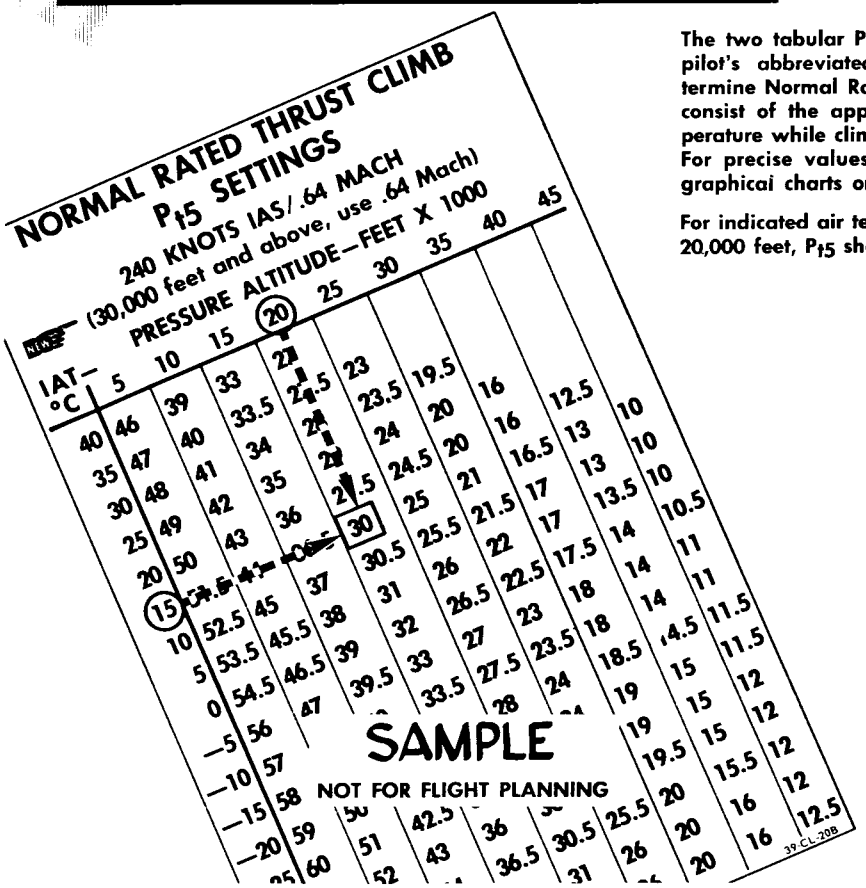

STANDARD DAY
DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23, AND NAA)
NORMAL RATED THRUST CLIMB—TWO ENGINES
240 KNOTS IAS OR .64 INDICATED MACH
MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4
NOTE
For each 10°C above Standard Day temperatures, add 1700 pounds to gross weight before using chart.
For each 10°C below Standard Day temperatures, subtract 1700 pounds from gross weight before using chart.
45,000 FT
44,000 FT
43,000 FT
42,000 FT
41,000 FT
40,000 FT
39,000 FT
38,000 FT
37,000 FT
36,000 FT
35,000 FT
100 FPM
300 FPM
GUIDE LINES
PRESSURE ALTITUDE — 30,000 FT
25,000 FT
20,000 FT
15,000 FT
10,000 FT
SEA LEVEL
TIME TO CLIMB—MINUTES
DISTANCE TRAVELED—NAUTICAL MILES
GROSS WEIGHT—1000 LB
39A-1-93-86

Figure A3-3

CLIMB THRUST SETTINGS–TABULAR



The two tabular P_{t5} charts in the performance section of the pilot's abbreviated checklist are for use during climb to determine Normal Rated or Military Thrust settings. These charts consist of the approximate values for an altitude and temperature while climbing at the recommended airspeed/Mach. For precise values, or values for other conditions, refer to graphical charts or computer.

For indicated air temperature of 15°C at pressure altitude of 20,000 feet, P_{t5} should be 30.

39A-1-93-72B

Figure A3-4

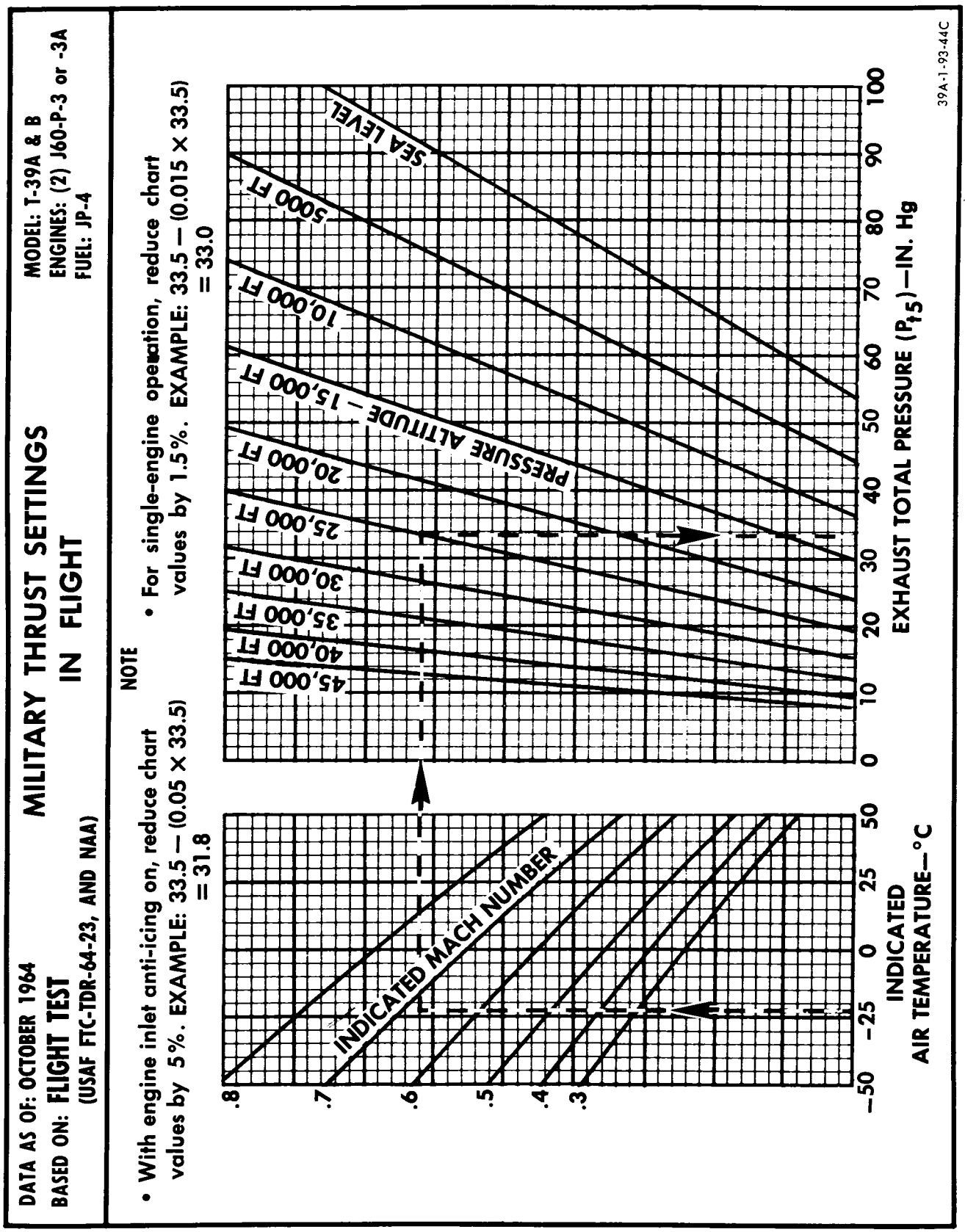

DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23, AND NAA)
MILITARY THRUST SETTINGS
IN FLIGHT
MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4
NOTE
• With engine inlet anti-icing on, reduce chart values by 5%. EXAMPLE: 33.5 − (0.05 × 33.5) = 31.8
• For single-engine operation, reduce chart values by 1.5%. EXAMPLE: 33.5 − (0.015 × 33.5) = 33.0
INDICATED MACH NUMBER
.8
.7
.6
.5
.4
.3
INDICATED AIR TEMPERATURE — °C
−50
−25
0
25
50
PRESSURE ALTITUDE — 15,000 FT
SEA LEVEL
5000 FT
10,000 FT
20,000 FT
25,000 FT
30,000 FT
35,000 FT
40,000 FT
45,000 FT
EXHAUST TOTAL PRESSURE (P_{t5}) — IN. Hg
0
10
20
30
40
50
60
70
80
90
100
39A-1-93-44C

Figure A3-5

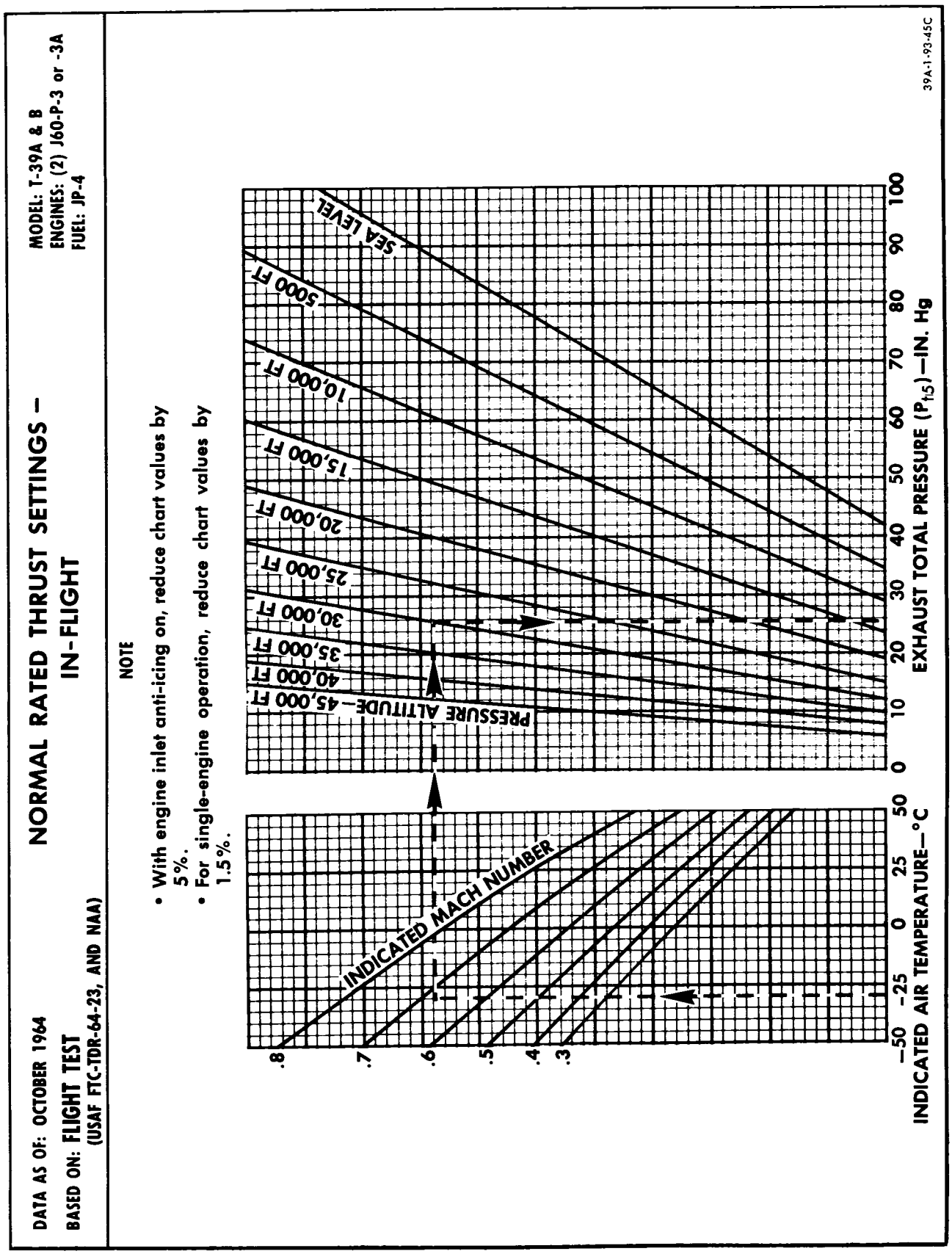

NORMAL RATED THRUST SETTINGS – IN-FLIGHT
DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST (USAF FTC-TDR-64-23, AND NAA)
MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4
NOTE
• With engine inlet anti-icing on, reduce chart values by 5%.
• For single-engine operation, reduce chart values by 1.5%.
PRESSURE ALTITUDE – 45,000 FT
40,000 FT
35,000 FT
30,000 FT
25,000 FT
20,000 FT
15,000 FT
10,000 FT
5000 FT
SEA LEVEL
INDICATED MACH NUMBER
.8
.7
.6
.5
.4
.3
0 10 20 30 40 50 60 70 80 90 100
EXHAUST TOTAL PRESSURE (P_{t5})—IN. Hg
–50 –25 0 25 50
INDICATED AIR TEMPERATURE—°C
39A-1-93-45C

Figure A3-6

PART 4-RANGE

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Titles CAPITALIZED denote charts.

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MAXIMUM RANGE PROFILE	A4-4A
SINGLE-ENGINE RETURN PROFILE	A4-4C
NAUTICAL MILES PER POUND OF FUEL - SAMPLE	A4-6
NAUTICAL MILES PER POUND OF FUEL - SEA LEVEL TO 25,000 FEET	A4-8
NAUTICAL MILES PER POUND OF FUEL - 25,000 FEET TO 45,000 FEET	A4-10
DIVERSION RANGE SUMMARY - SAMPLE	A4-12

RANGE

RANGE.

As engine performance is affected by Mach number, rpm, and altitude, the drag curve indicates flexibility in both the optimum cruise Mach number and altitude. Within this flexibility, there is a definite range or span of Mach and altitude that will produce near maximum range. Variations of free air temperature can have an important effect on the long-range cruise performance. The Maximum Thrust at which an airplane can cruise is Normal Rated Thrust. For some conditions, the thrust loss due to an increase in free air temperature has only the small effect of requiring a higher cruise engine speed and perhaps a slightly higher specific fuel consumption. However, increased free air temperature also increases the true airspeed at a constant Mach number; consequently, specific range is not seriously affected. Remember that Mach number is the choice parameter for precise cruise control. If the cruise were to be performed at the optimum cruise altitude and the optimum altitude were thrust-limited on a Standard Day, then free air temperatures above standard would reduce the range by reducing the altitude for cruise.

OPERATIONAL RANGE PROFILE.

These charts (figures A4-1 and A4-1A) give the time, fuel, distance, and altitude relationship to operational range for no-wind conditions. This relationship is based on a sequence of take-off, Military thrust climb to any desired altitude up to 40,000 feet, and maximum range cruise. A cruise-climb condition from 40,000 to 45,000 feet is also given. A cruise table gives recommended Mach numbers and approximate operating conditions for both cruise at constant altitude and for cruise-climb procedure. The fuel flows shown on the table vary because of the effect of gross weight reduction during cruise. The fuel curves include a 380-pound allowance for start, taxi, take-off, and acceleration to climb

speed, plus the fuel used in climb to each altitude, as well as the fuel required for operational range cruise. The time lines include the time required to climb to cruise altitude, but do not include the time to start, taxi, or take off. The line labeled "INITIAL CLIMB PATH" shows the distance traveled and time consumed during the Military Thrust climb from sea level to cruising altitude.

For cruise at a constant altitude, set up the recommended Mach number at the intersection of the climb path and cruise altitude. As the flight progresses, the thrust setting must be decreased gradually as fuel is consumed, to maintain the recommended Mach number. For cruise-climb, level off at 40,000 feet and set up the thrust setting and Mach number given for cruise-climb procedure. The airplane will automatically climb as fuel is consumed, to seek the cruise-climb altitude for its particular gross weight. Maintain the initial thrust setting and Mach number throughout the remainder of cruise-climb. The chart does not include fuel for descent and landing.

The chart may be entered with one or more of the four range factors: time, fuel, distance, and altitude. By entering the chart with the known factors, the others may readily be determined. This is for a no-wind condition.

To determine wind effect upon time, fuel, and distance, compute ground speed and air distance to be traveled (ground speed equals TAS minus head winds). Divide distance by ground speed to obtain time to travel. Enter profile with time to travel, and move to the cruise altitude to obtain the fuel required with wind.

SAMPLE PROBLEM (FIGURE A4-1).

Find the necessary speed, time, and fuel required to cruise 550 nautical miles at 30,000 feet with a head wind of 50 knots.

a. TAS as shown at 30,000 ft . . . . . 370 kn (.63 Mach No.)
b. Ground speed (370 minus 50) . . . . . 320 kn
c. Time required to fly 550 naut mi with head wind (550 ÷ 320). . . . . 1 hr 43 min
d. Enter chart at time (with wind) and 30,000 ft to get fuel required . . . . 3500 lb

MAXIMUM RANGE PROFILE.

The maximum range profile (figures A4-2 and A4-2A) is similar in content and method of operation to the operational range profile with the exception of differing cruise speeds and thrust requirements. As the title implies, the maximum range profile primarily considers maximum range per pound of fuel. When using the maximum range profile chart, use the recommended thrust setting and Mach number as indicated in the cruise chart for the desired conditions.

SINGLE-ENGINE RETURN PROFILE.

The single-engine return profile chart (figures A4-3 and A4-3A) shows the relationship of fuel remaining to distance. The chart may be entered at the initial altitude with the fuel remaining, to determine the range available, or with the distance to be flown, to determine the fuel required. No fuel reserve has been included. The table on the chart shows average cruise airspeed and approximate fuel flow, which will vary because of gross weight, for sea level and 10,000 and 20,000 feet.

NAUTICAL-MILES-PER-POUND-OF-FUEL CHARTS.

Cruise data (zero wind) throughout the speed range from maximum endurance to Military Thrust are shown in the nautical-miles-per-pound-of-fuel charts. The charts include specific range (nautical miles per pound), fuel flow, true Mach number, and true airspeed. Also included are curves of maximum range, operational range, and Normal Rated Thrust. Because of the extended range of the airplane, the range data is presented in two sets of charts with altitudes from sea level to 25,000 feet (figure A4-5) and altitudes from 25,000 feet to 45,000 feet (figure A4-6).

Airplane cruising range is the product of specific range multiplied by pounds of fuel available for cruise:

$$\text{Range} = \frac{\text{Naut Mi}}{\text{Lb}} \text{ X Lb of Fuel}$$

When there is a wind to be considered, multiply specific range by the range factor (ground speed divided by true airspeed) to obtain the specific range for wind.

For greatest accuracy in determining cruising range, consider small amounts of fuel at a time rather than the total fuel available. By this method, the total cruising range is the sum of the individual ranges obtained for each amount of fuel.

The maximum range line is a base line, and when range is being computed for other than maximum range, the guidelines are followed from this base line to the desired point. In this manner, range may be determined for maximum range, maximum endurance, operational range, Normal Rated Thrust, Military Thrust, or for a desired true Mach number or true airspeed. Use of the chart is explained by a sample problem. (See figure A4-4.)

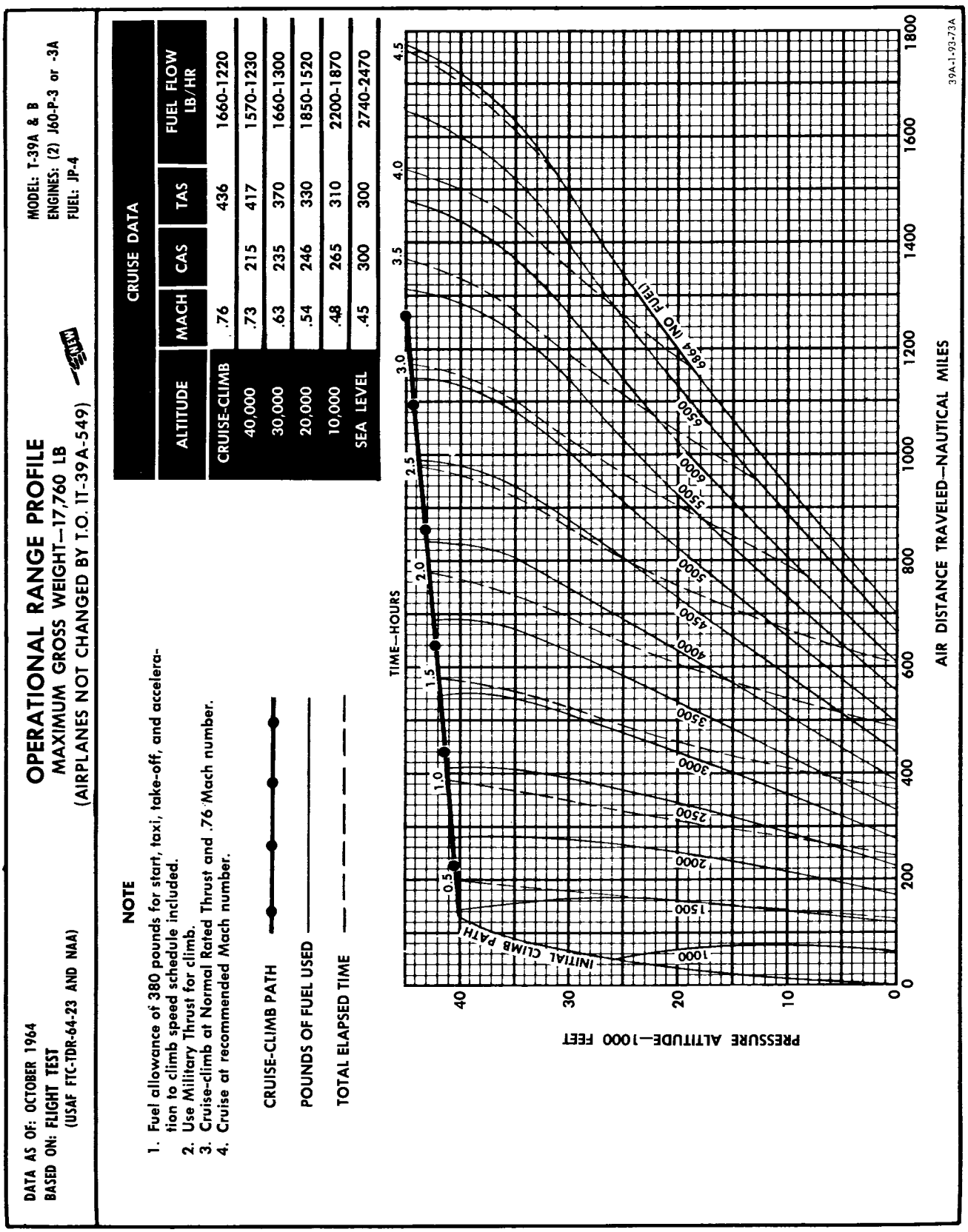

DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23 AND NAA)
OPERATIONAL RANGE PROFILE
MAXIMUM GROSS WEIGHT—17,760 LB
(AIRPLANES NOT CHANGED BY T.O. 1T-39A-549)
NEW
MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4
NOTE
1. Fuel allowance of 380 pounds for start, taxi, take-off, and acceleration to climb speed schedule included.
2. Use Military Thrust for climb.
3. Cruise-climb at Normal Rated Thrust and .76 Mach number.
4. Cruise at recommended Mach number.
CRUISE-CLIMB PATH
POUNDS OF FUEL USED
TOTAL ELAPSED TIME
CRUISE DATA
ALTITUDE | MACH | CAS | TAS | FUEL FLOW LB/HR
CRUISE-CLIMB | .76 | | 436 | 1660-1220
40,000 | .73 | 215 | 417 | 1570-1230
30,000 | .63 | 235 | 370 | 1660-1300
20,000 | .54 | 246 | 330 | 1850-1520
10,000 | .48 | 265 | 310 | 2200-1870
SEA LEVEL | .45 | 300 | 300 | 2740-2470
INITIAL CLIMB PATH
6864 LBS FUEL
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
TIME—HOURS
PRESSURE ALTITUDE—1000 FEET
AIR DISTANCE TRAVELED—NAUTICAL MILES
0
10
20
30
40
200
400
600
800
1000
1200
1400
1600
1800
39A-1-93-73A

Figure A4-1

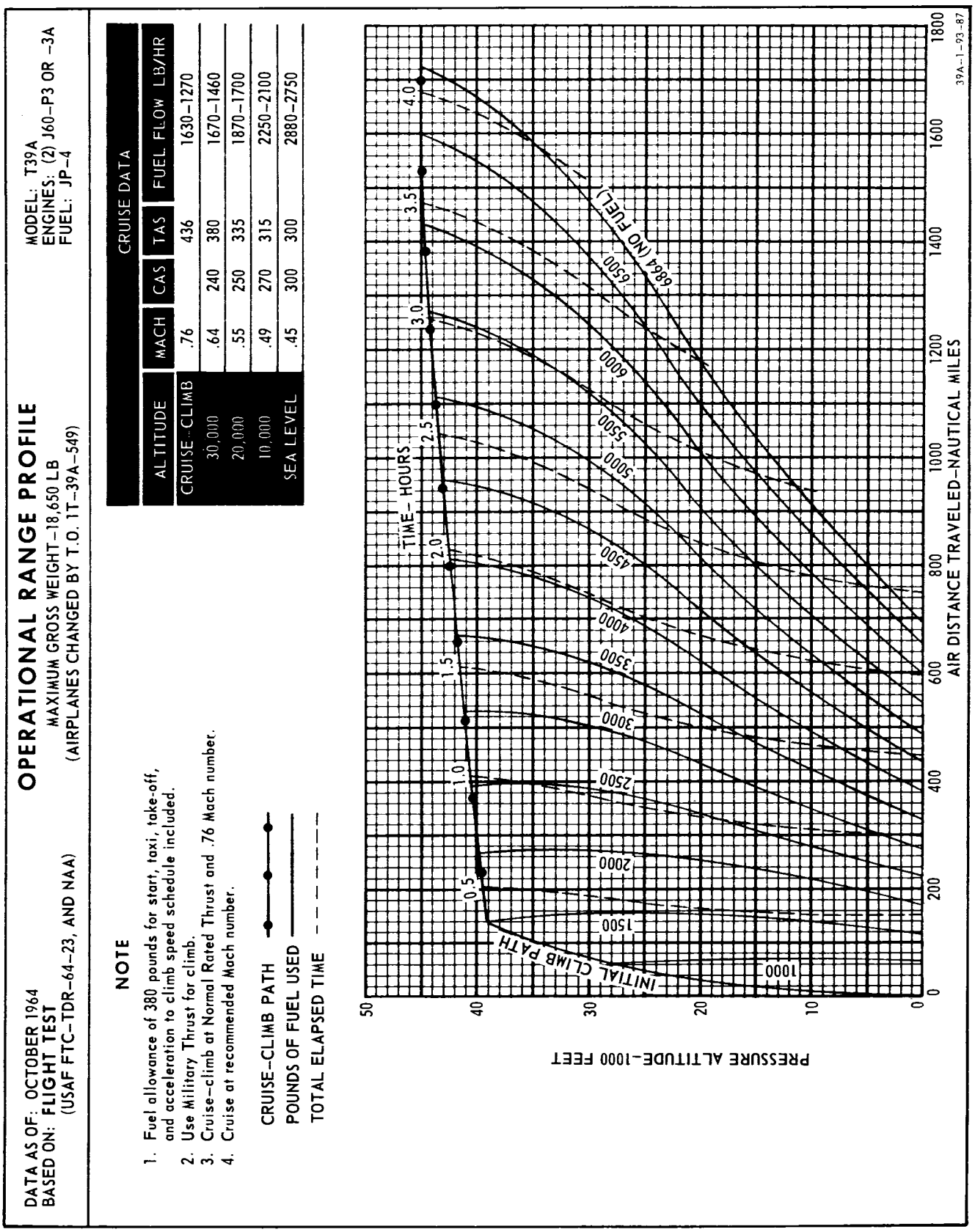

OPERATIONAL RANGE PROFILE
DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23, AND NAA)
MAXIMUM GROSS WEIGHT-18,650 LB
(AIRPLANES CHANGED BY T.O. 1T-39A-549)
MODEL: T39A
ENGINES: (2) J60-P3 OR -3A
FUEL: JP-4
NOTE
1. Fuel allowance of 380 pounds for start, taxi, take-off, and acceleration to climb speed schedule included.
2. Use Military Thrust for climb.
3. Cruise-climb at Normal Rated Thrust and .76 Mach number.
4. Cruise at recommended Mach number.
CRUISE-CLIMB PATH
POUNDS OF FUEL USED
TOTAL ELAPSED TIME
CRUISE DATA
ALTITUDE | MACH | CAS | TAS | FUEL FLOW LB/HR
CRUISE-CLIMB | .76 | | 436 | 1630-1270
30,000 | .64 | 240 | 380 | 1670-1460
20,000 | .55 | 250 | 335 | 1870-1700
10,000 | .49 | 270 | 315 | 2250-2100
SEA LEVEL | .45 | 300 | 300 | 2880-2750
INITIAL CLIMB PATH
6864 (NO FUEL)
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
TIME- HOURS
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
PRESSURE ALTITUDE-1000 FEET
0
10
20
30
40
50
AIR DISTANCE TRAVELED-NAUTICAL MILES
0
200
400
600
800
1000
1200
1400
1600
1800
39A-1-93-87

Figure A4-1A

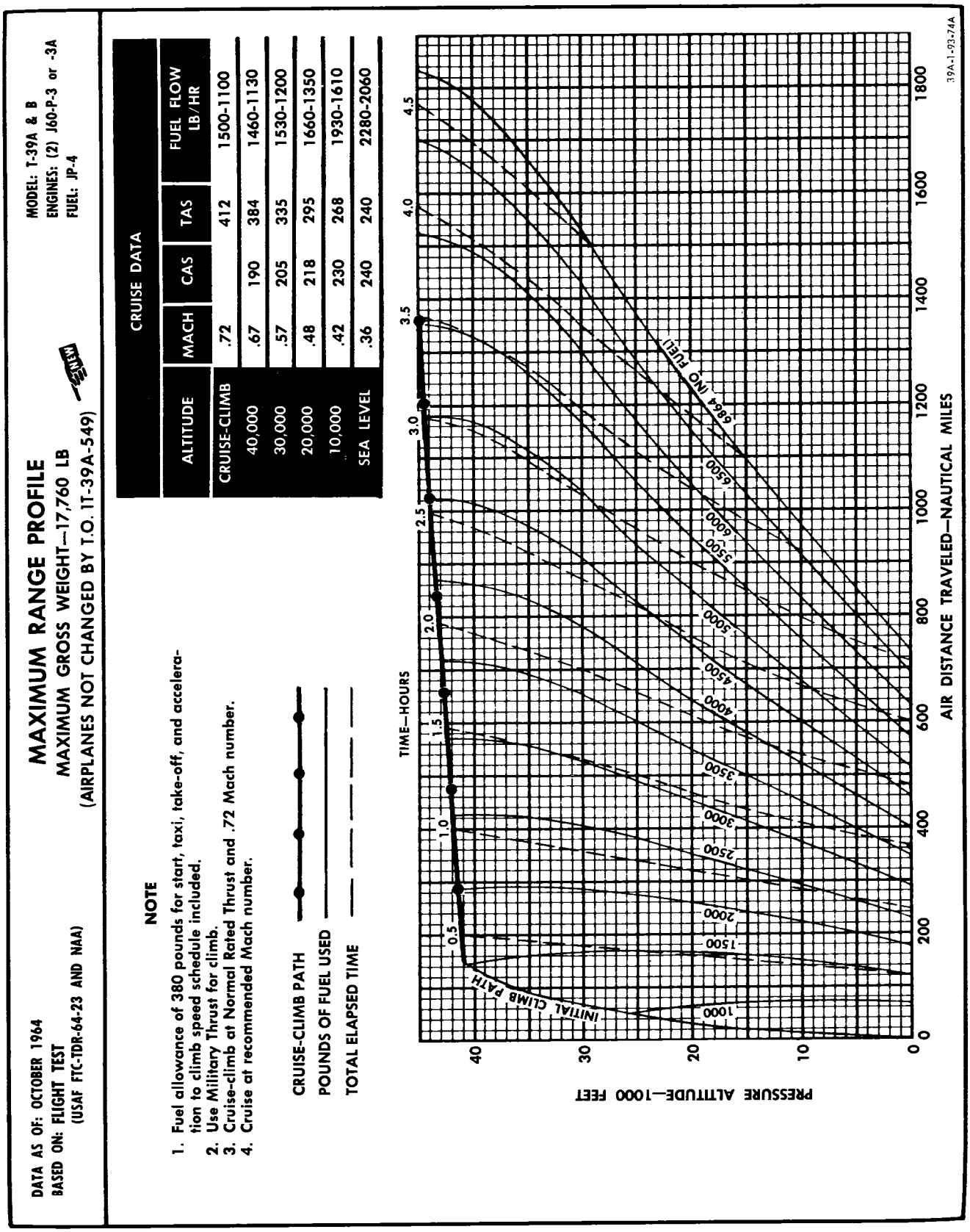

DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23 AND NAA)
MAXIMUM RANGE PROFILE
MAXIMUM GROSS WEIGHT—17,760 LB
(AIRPLANES NOT CHANGED BY T.O. 1T-39A-549)
NEW
MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4
CRUISE DATA
ALTITUDE | MACH | CAS | TAS | FUEL FLOW LB/HR
CRUISE-CLIMB | .72 | | 412 | 1500-1100
40,000 | .67 | 190 | 384 | 1460-1130
30,000 | .57 | 205 | 335 | 1530-1200
20,000 | .48 | 218 | 295 | 1660-1350
10,000 | .42 | 230 | 268 | 1930-1610
SEA LEVEL | .36 | 240 | 240 | 2280-2060
NOTE
1. Fuel allowance of 380 pounds for start, taxi, take-off, and acceleration to climb speed schedule included.
2. Use Military Thrust for climb.
3. Cruise-climb at Normal Rated Thrust and .72 Mach number.
4. Cruise at recommended Mach number.
CRUISE-CLIMB PATH
POUNDS OF FUEL USED
TOTAL ELAPSED TIME
TIME—HOURS
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
INITIAL CLIMB PATH
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
6864 LBS FUEL
PRESSURE ALTITUDE—1000 FEET
0
10
20
30
40
AIR DISTANCE TRAVELED—NAUTICAL MILES
0
200
400
600
800
1000
1200
1400
1600
1800
39A-1-93-74A

Figure A4-2

DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-24-23, AND NAA)

MAXIMUM RANGE PROFILE

MAXIMUM GROSS WEIGHT-18,650 LB
(AIRPLANES CHANGED BY T.O. 1T-39A-549)

MODEL: T-39A
ENGINES: (2) J60-P-3 OR -3A
FUEL: JP-4

NOTE

1. Fuel allowance of 380 pounds for start, taxi, take-off, and acceleration to climb speed schedule included.
2. Use Military Thrust for climb.
3. Cruise-climb at Normal Rated Thrust and .72 Mach number.
4. Cruise at recommended Mach number.

CRUISE CLIMB PATH
POUNDS OF FUEL USED
TOTAL ELAPSED TIME

CRUISE DATA				
ALTITUDE	MACH	CAS	TAS	FUEL FLOW LB/HR
CRUISE CLIMB	.72		412	1570-1120
40,000	.67	190	384	1540-1140
30,000	.57	205	335	1600-1210
20,000	.48	218	295	1770-1370
10,000	.42	230	268	2010-1580
SEA LEVEL	.36	240	240	2400-2010

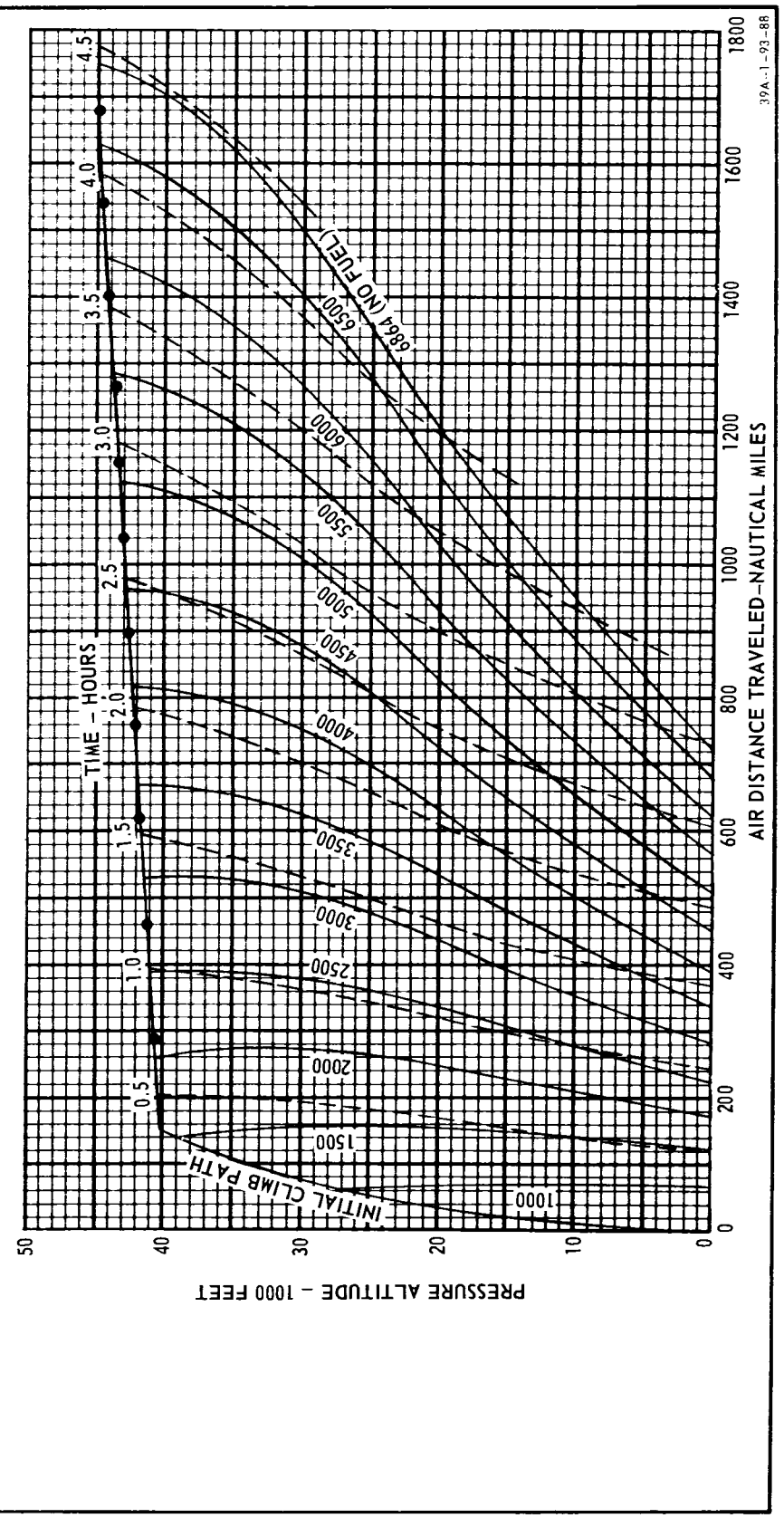


Figure A4-2A

DATA AS OF: OCTOBER 1964
BASED ON: **FLIGHT TEST**
(USAF FTC-TDR-64-23, AND NAA)

SINGLE-ENGINE RETURN PROFILE

MAXIMUM GROSS WEIGHT — 17,760 LB
(AIRPLANES NOT CHANGED BY T.O. 1T-39A-549) NEW

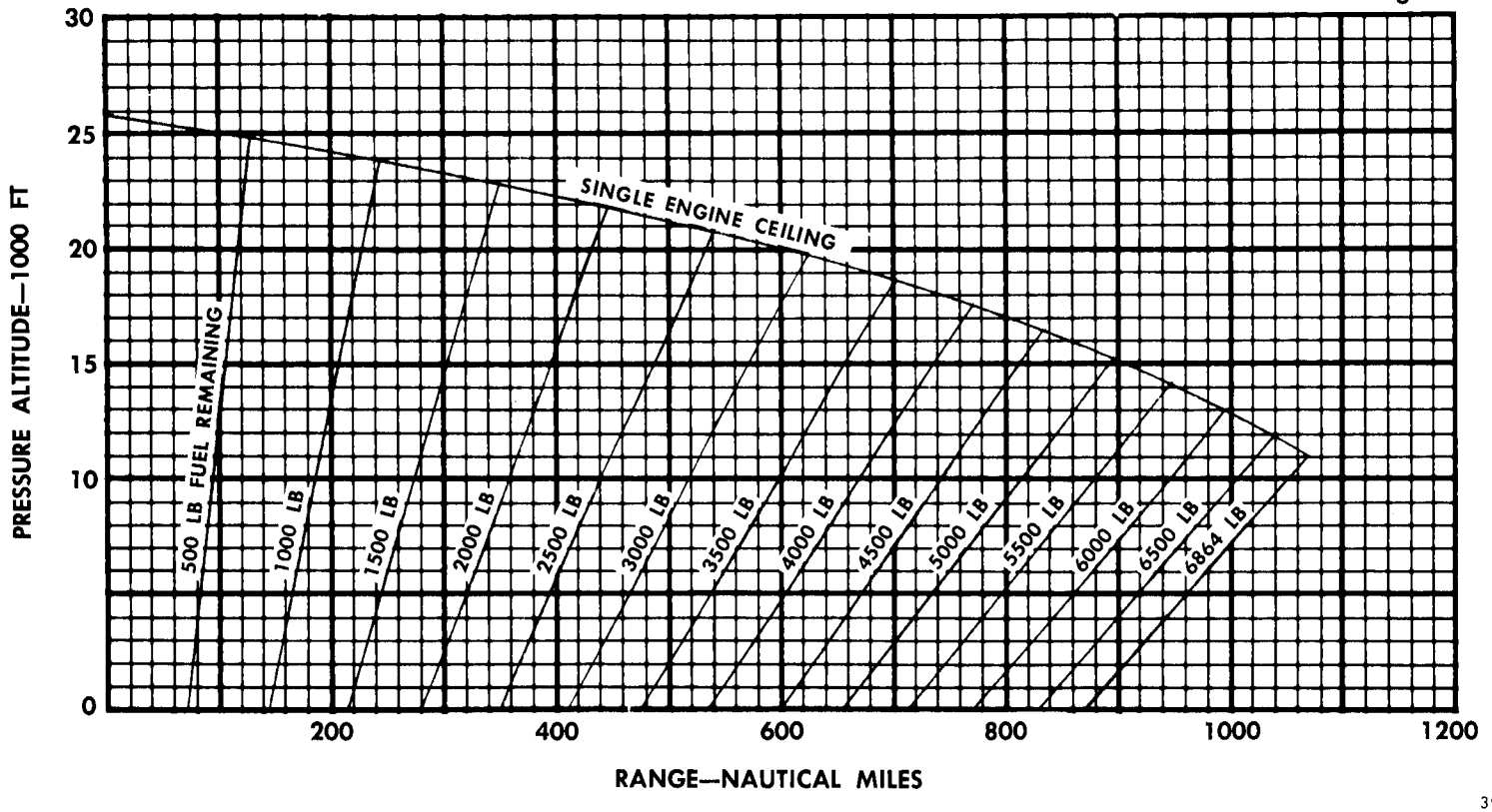
MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4

NOTE

- Data does not include any reserve fuel.
- Single-engine ceiling is based on Normal Rated Thrust.

PRESSURE ALT—FT	MACH NO.	APPROXIMATE CAS	APPROXIMATE TAS*	APPROXIMATE FUEL FLOW LB/HR
CRUISE CLIMB			266	1710 TO 990
20,000	.414	191	254	1250 TO 1050
10,000	.368	203	235	1530 TO 1220
SEA LEVEL	.322	213	213	1690 TO 1430

* Average



39A-1-93-75A

Figure A4-3

DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23,
AND NAA)

SINGLE ENGINE RETURN PROFILE

MAXIMUM GROSS WEIGHT - 18,650 LB
(AIRPLANES CHANGED BY T.O. 1T-39A-549)

MODEL: T-39A
ENGINE: J60-P-3 OR -3A
FUEL: JP-4

PRESSURE ALTITUDE FEET	MACH NO	APPROXIMATE		
		CAS	TAS*	FUEL FLOW LB/HR
CRUISE CLIMB			269	1820-1080
15,000	.426	211	263	1530-1130
10,000	.391	217	248	1730-1200
5,000	.363	220	236	1850-1250
SEA LEVEL	.349	229	229	1950-1390

* AVERAGE

NOTE

- Data does not include any reserve fuel.
- Single-engine ceiling is based on Normal Rated Thrust.

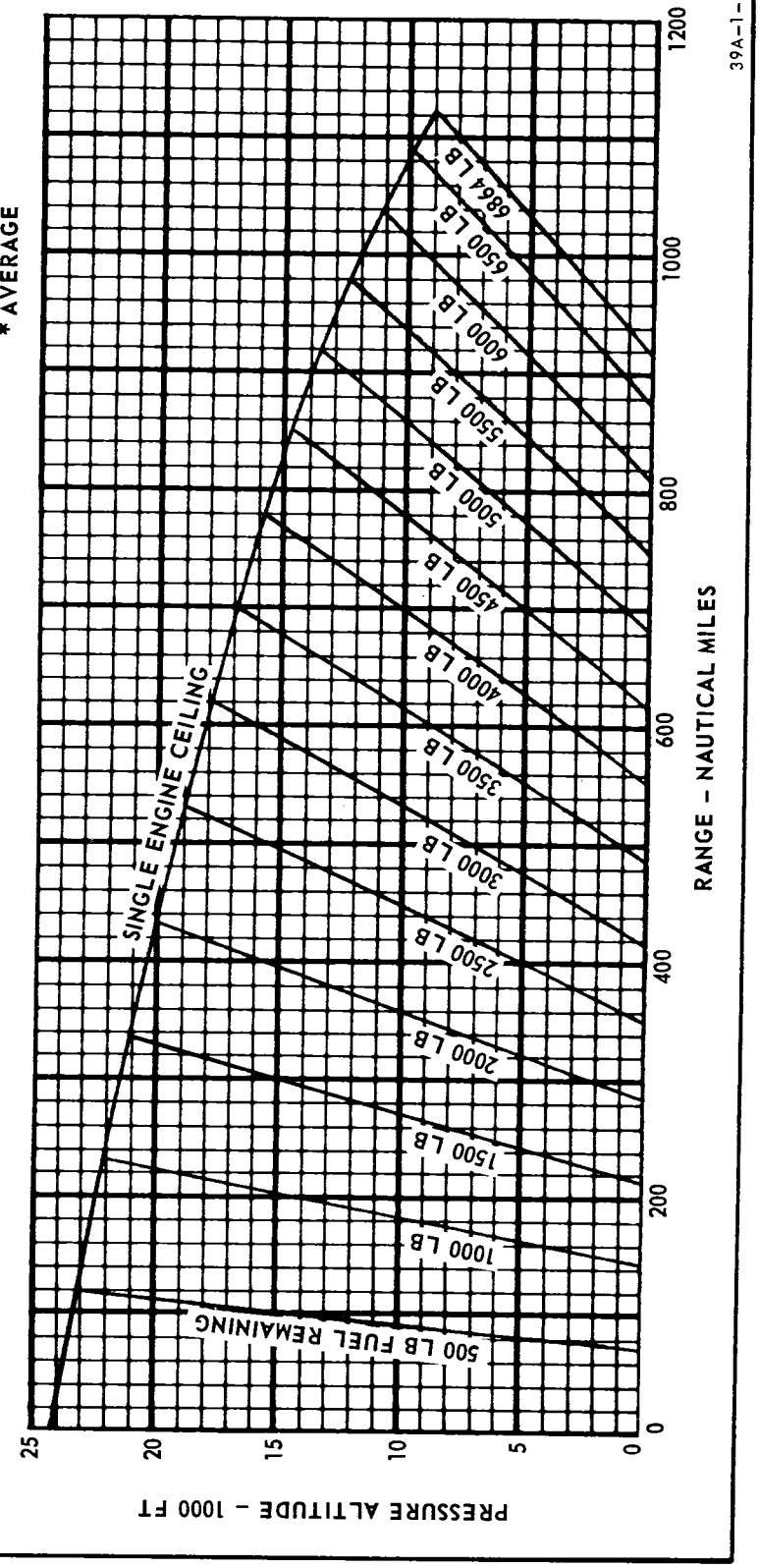


Figure A4-3A

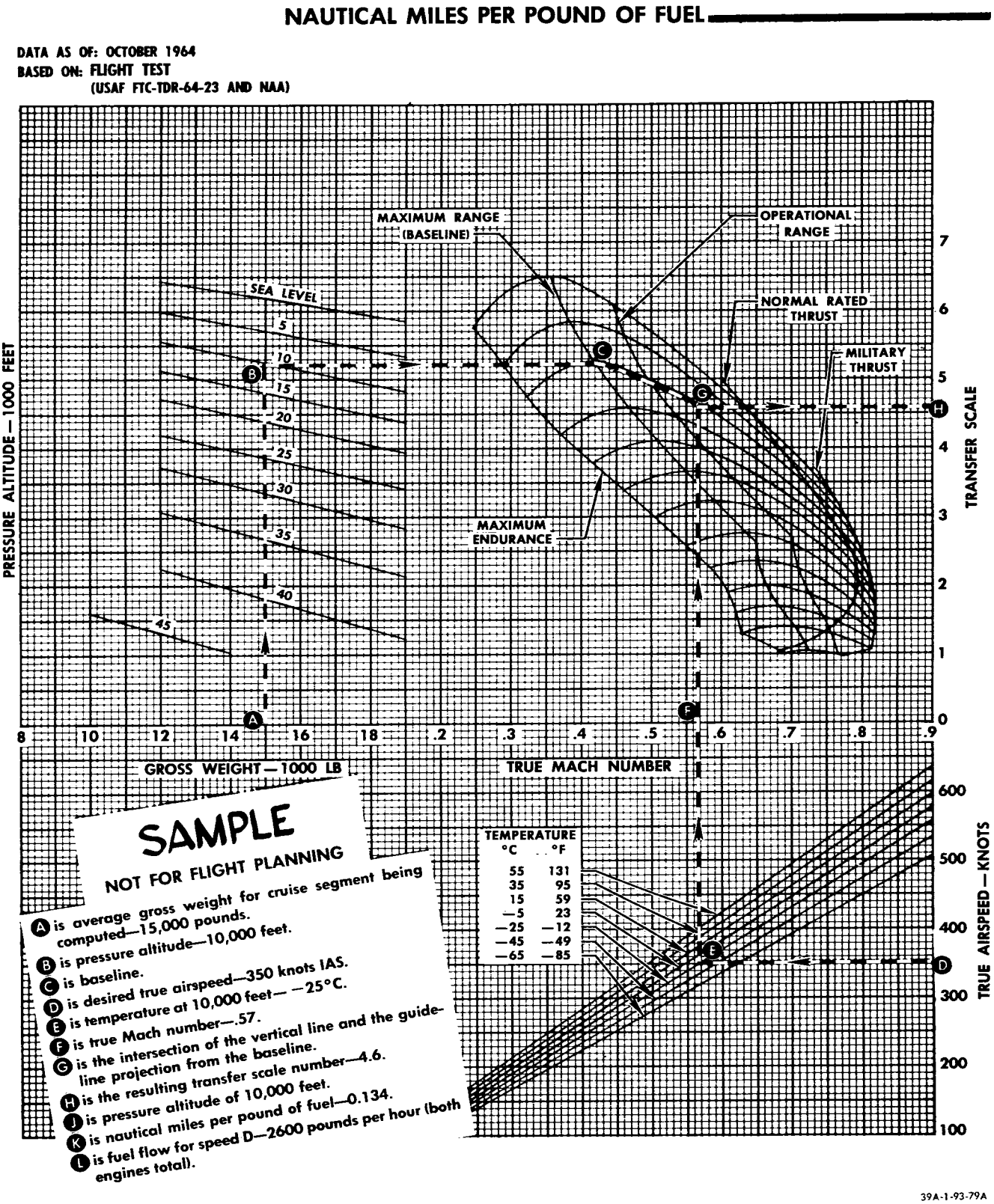
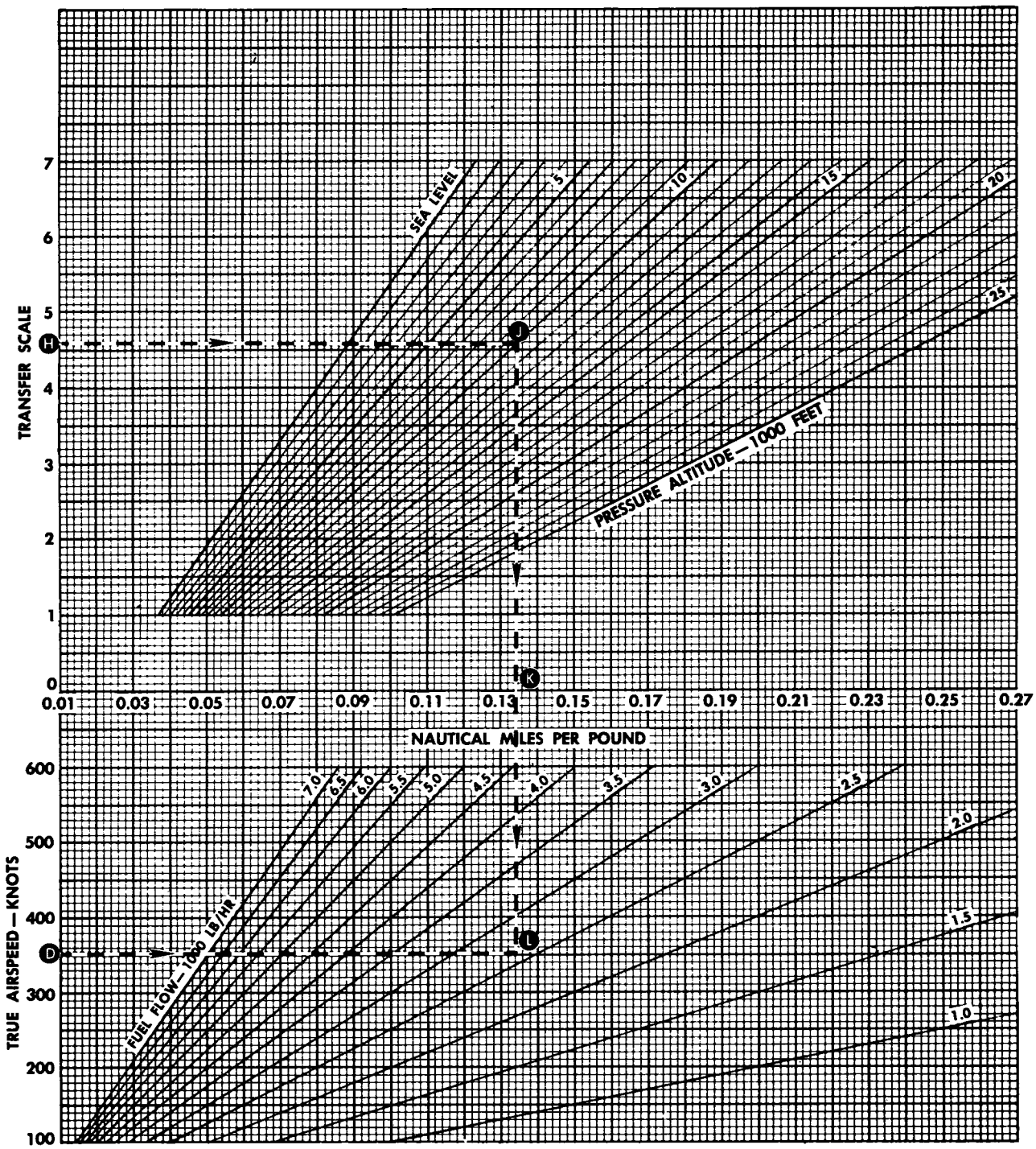

NAUTICAL MILES PER POUND OF FUEL
DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23 AND NAA)
MAXIMUM RANGE (BASELINE)
OPERATIONAL RANGE
NORMAL RATED THRUST
MILITARY THRUST
MAXIMUM ENDURANCE
SEA LEVEL
5
10
15
20
25
30
35
40
45
PRESSURE ALTITUDE — 1000 FEET
TRANSFER SCALE
GROSS WEIGHT — 1000 LB
TRUE MACH NUMBER
TRUE AIRSPEED — KNOTS
SAMPLE
NOT FOR FLIGHT PLANNING
TEMPERATURE
°C °F
55 131
35 95
15 59
—5 23
—25 —12
—45 —49
—65 —85
A is average gross weight for cruise segment being computed—15,000 pounds.
B is pressure altitude—10,000 feet.
C is baseline.
D is desired true airspeed—350 knots IAS.
E is temperature at 10,000 feet— —25°C.
F is true Mach number—.57.
G is the intersection of the vertical line and the guide-line projection from the baseline.
H is the resulting transfer scale number—4.6.
J is pressure altitude of 10,000 feet.
K is nautical miles per pound of fuel—0.134.
L is fuel flow for speed D—2600 pounds per hour (both engines total).
39A-1-93-79A

Figure A4-4

SEA LEVEL TO 25,000 FEET

MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4



39A-1-93-80A

NAUTICAL MILES PER POUND OF FUEL

DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23 AND NAA)

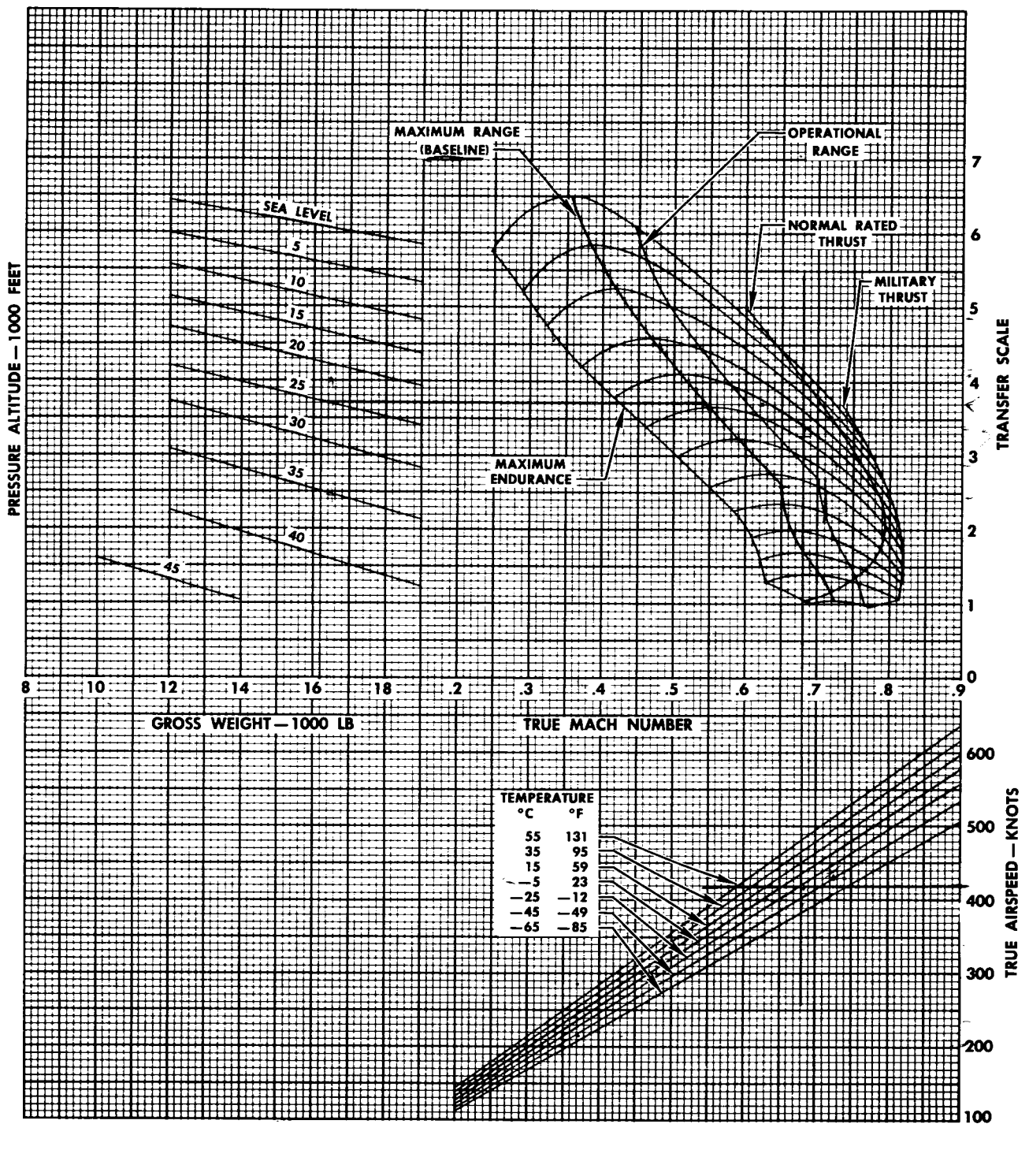
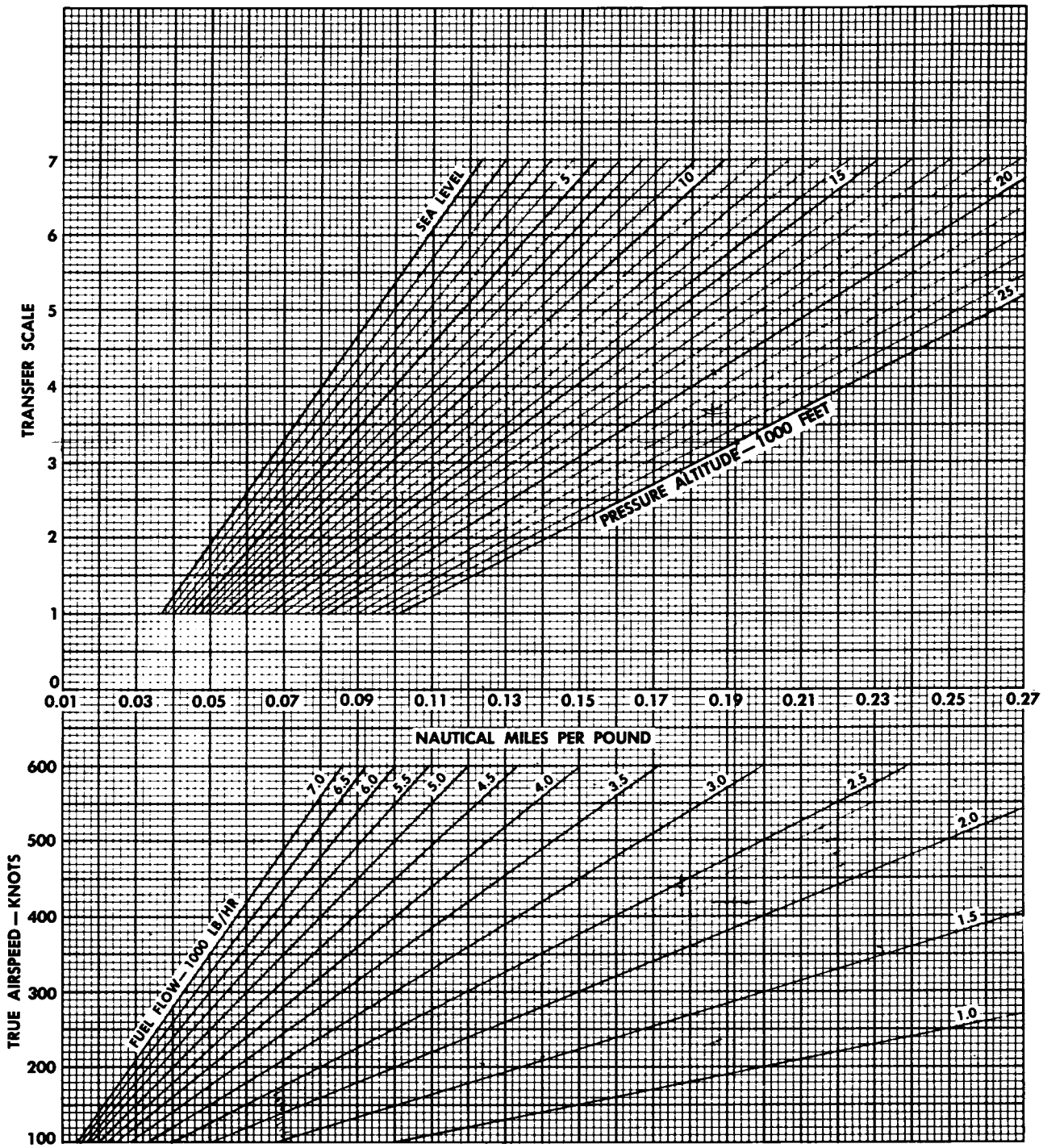


Figure A4-5

SEA LEVEL TO 25,000 FEET

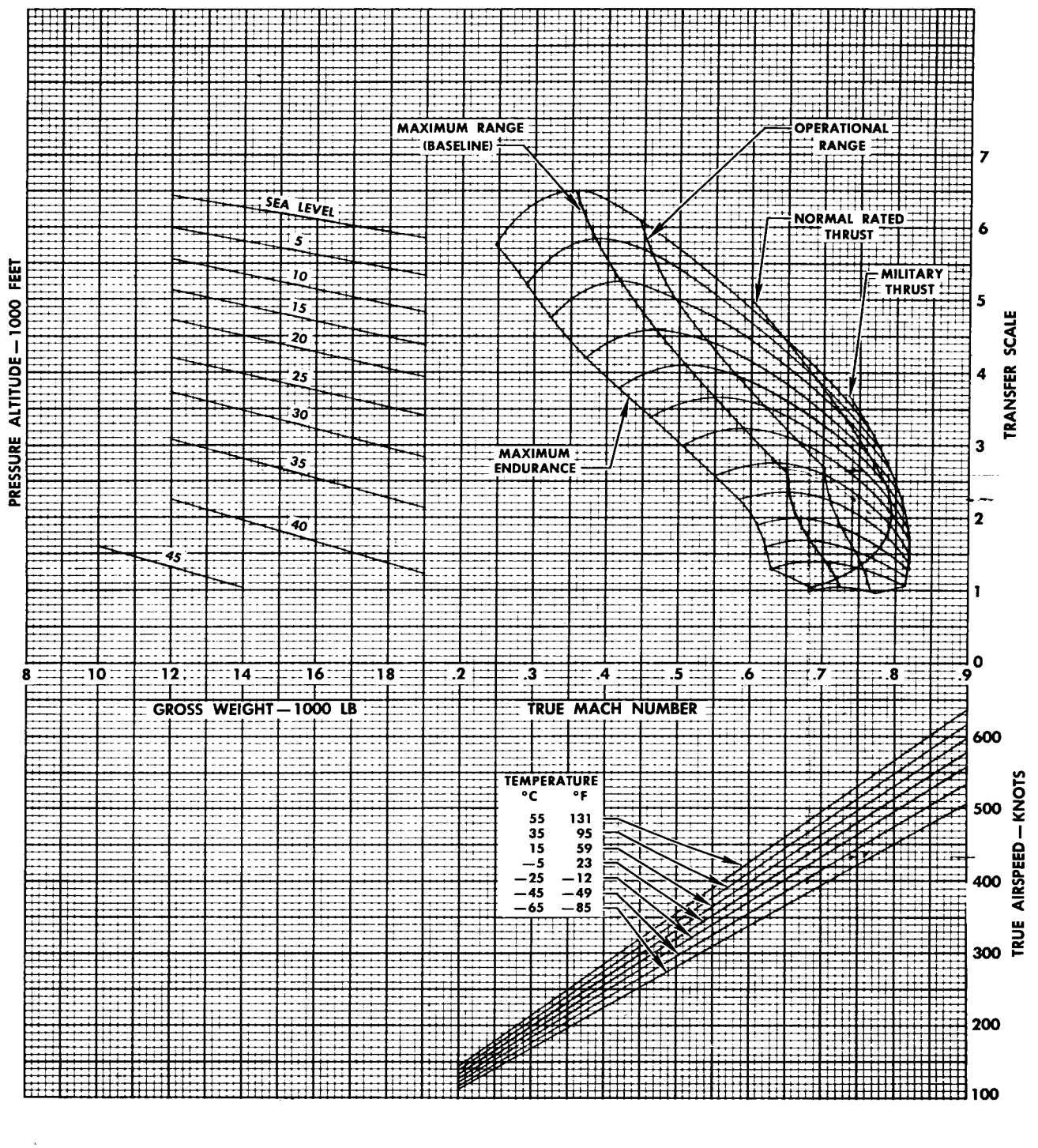
MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4



39A-1-93-77A

NAUTICAL MILES PER POUND OF FUEL

DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23 AND NAA)

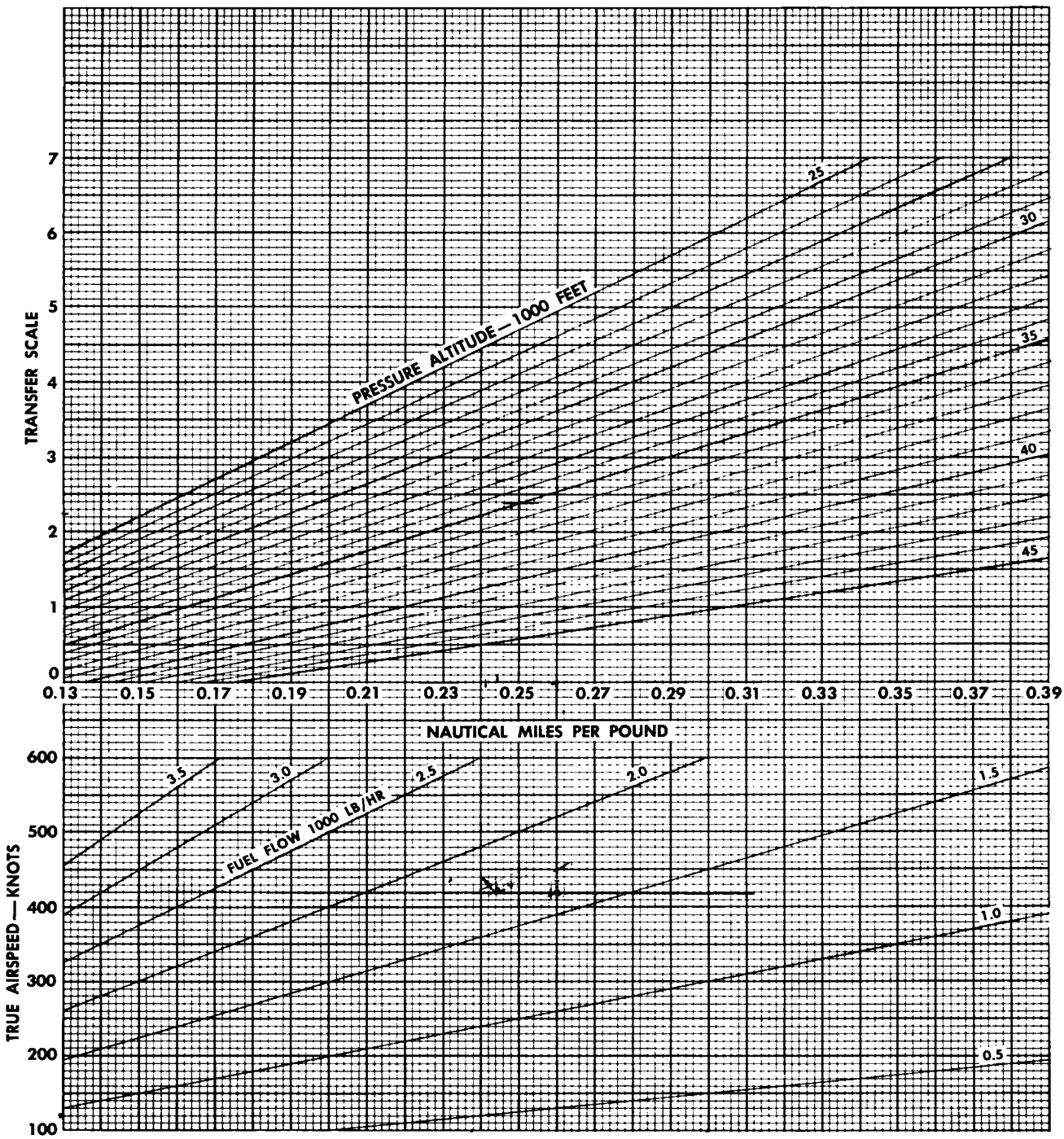


39A-1-93-76B

Figure A4-6

25,000 FEET TO 45,000 FEET

MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4



39A-1-93-78A

DIVERSION RANGE SUMMARY

The diversion range summary chart enables determination of range and time remaining when fuel quantity is 3000 pounds or less. Data is provided for three separate conditions. The first is the range and time for cruise only at the initial altitude. The second is for climb to, and cruise at, optimum altitude. In this condition, time for descent is included; however, no credit is taken for distance. The third set of values is for maximum conditions. These values include range and time to climb to, and cruise at, optimum altitude plus range and time for a maximum–range, on course descent to sea level. A maximum–range descent table is at the bottom of the chart. Application of any of these descent values for the appropriate cruise altitude determines the starting point for maximum – range on–course descent.

It must be noted that with 500 pounds of fuel remaining, the initial altitude is also the optimum altitude, as the fuel required to climb is better used for cruise. With 1000 pounds of fuel remaining, an advantage can be obtained in climbing. The chart in the 1000–pound area presents split or divided optimum altitude boxes. The first altitude is the optimum altitude when a minimum–time descent is made, and the guide arrow indicates the range and time to be used. The second altitude is the optimum altitude when a maximum–range on–course descent is made with the guide arrow again indicating the proper values to be used.

DIVISION RANGE SUMMARY CHART (SHEET 1 OF 2)
STANDARD DAY - ZERO WIND

DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23 AND NAA)

SAMPLE

NOT FOR FLIGHT PLANNING

RANGE AND TIME REMAINING WITH 400 LBS RESERVE AT S.L.

FUEL		INITIAL ALTITUDE								NOTE
	1000 FEET	SL	5	10	15	20	25	30	35	40	
	NAUT MI	12	13	15	17	18	20	22	24	24	①
	MIN	3.0	3.3	3.5	3.8	4.0	4.1	4.3	4.2	3.9	
		OPTIMUM ALTITUDE									
500 LBS	1000 FEET	SL	5	10	15	20	25	30	35	40	
	NAUT MI	12	13	15	17	18	20	22	24	24	②
	MIN	3.0	3.7	4.2	4.8	5.3	5.7	6.2	6.6	6.8	
	NAUT MI	12	17	23	27	33	37	43	49	56	③
	MIN	3.0	4.0	4.7	5.4	6.1	6.5	7.1	7.7	8.5	
	NAUT MI	70	82	94	107	121	136	157	173	189	①
	MIN	17.8	20.1	22.1	24.3	26.2	27.4	29.6	30.6	30.3	
		OPTIMUM ALTITUDE									
1000 LBS	1000 FEET	30	30	30	30/35	30/35	30/40	30/40	35/40	40	
	NAUT MI	87	101	109	115	125	143	157	173	189	②
	MIN	17.7	20.7	22.1	23.1	25.2	28.7	31.5	33.0	33.2	
	NAUT MI	107	122	130	142	156	171	190	203	221	③
	MIN	18.7	21.6	23.1	24.1	26.6	26.9	29.8	31.9	34.9	
	NAUT MI	127	[illegible]	172	197	223	251	289	320	350	①
	MIN	32.4	36.7	40.5	44.3	47.8	50.2	54.3	55.9	56.0	
		OPTIMUM ALTITUDE									
1500 LBS	1000 FEET	40	40	40	40	40	40	40	40	40	
	NAUT MI	226	245	255	262	285	305	321	335	350	②
	MIN	39.9	43.0	44.5	45.3	48.8	51.8	54.2	56.3	58.9	
	NAUT MI	258	277	287	294	317	337	353	367	382	③
	MIN	41.6	44.7	46.2	47.0	50.5	53.5	55.9	58.0	60.6	
	NAUT MI	184	217	249	285	324	364	420	464	508	①
	MIN	46.8	53.1	58.6	64.0	69.2	72.5	78.6	80.5	81.1	
		OPTIMUM ALTITUDE									
2000 LBS	1000 FEET	40	40	40	40	40	40	40	40	40	
	NAUT MI	366	388	393	411	437	458	478	495	508	②
	MIN	62.1	65.6	66.4	69.0	72.9	76.2	79.3	81.9	84.0	
	NAUT MI	398	420	426	443	469	490	510	528	540	③
	MIN	63.8	67.3	68.1	70.7	74.6	78.8	80.9	83.6	85.7	

T-39-CL-28

39A-1-93-82A

Figure A4-7

DIVERSION RANGE SUMMARY CHART (SHEET 2 OF 2)
STANDARD DAY ZERO WIND

MODEL: T-39A & B
ENGINE: (2) J60-P-3 or -3A
FUEL: JP-4

SAMPLE

NOT FOR FLIGHT PLANNING

FUEL		INITIAL ALTITUDE									
	1000 FEET	SL	5	10	15	20	25	30	35	40	NOTE
	NAUT MI	241	284	326	373	423	477	549	607	663	
	MIN	61.2	69.3	76.3	83.3	90.0	94.4	102.2	104.5	105.6	(1)
		OPTIMUM ALTITUDE									
2500 LBS	1000 FEET	40	40	40	40	40	40	40	40	40	
	NAUT MI	517	539	544	577	601	617	636	655	663	
	MIN	86.3	89.7	90.4	95.5	99.2	101.5	104.3	107.7	108.5	(2)
	NAUT MI	550	571	576	609	633	649	668	687	695	
	MIN	87.9	91.4	92.1	97.2	100.9	103.2	106.0	108.9	110.2	(3)
	NAUT MI	298	350	402	460	522	588	677	747	815	
	MIN	75.4	85.3	93.8	102.2	110.5	115.8	125.3	127.8	129.5	(1)
		OPTIMUM ALTITUDE									
3000 LBS (4)	1000 FEET	40	40	40	40	40	40	40	40	40	
	NAUT MI	673	693	704	737	759	779	796	798	815	
	MIN	110.9	114.2	115.6	120.8	124.1	126.9	129.5	129.8	132.4	(2)
	NAUT MI	705	726	736	769	792	811	828	830	847	
	MIN	[illegible] 5	115.9	117.3	122.5	125.8	128.7	131.3	131.5	134.1	(3)
CRUISE ALTITUDE		SL	5	10	15	20	25	30	35	40	
CRUISE TRUE MACH NO.		.36	.38	.40	.43	.46	.51	.55	.61	.66	
MAX RANGE DESCENT-IDLE THRUST, SPEED BRAKE CLOSED, 0.7 IMN OR 325 KIAS	DESCENT DISTANCE	5	10	14	19	24	30	37	47		
	FUEL USED	10	19	26	34	43	52	61	72		
	TIME TO DESCEND	0.9	1.6	2.3	3.1	3.8	4.6	5.6	7.0		

G

H

J

NOTE

(1) Cruise at initial altitude to base: no credit taken for descent time and distance. Minimum time descent used.

(2) Cruise at optimum altitude until over base: time, fuel and distance included for climb from initial to optimum altitude. No credit taken for descent distance. Minimum time descent used.

(3) Cruise at optimum altitude and descend on course: time, fuel and distance included for climb from initial to optimum altitude and for descent on course to S. L. destination. Maximum range descent used.

(4) With more than 3000 lbs fuel aboard, cruise at recommended cruise altitude and Mach number.

NOTE

- Schedules provide for arrival at S. L. with 400 lbs reserve for approach and landing.
- Climb at 270 KIAS or .68 IMN with Military Thrust.

T-39-CL-29

EXAMPLE

Step 1. Determine appropriate column.

- (A) is initial altitude (10,000 FT)
- (B) is fuel remaining (1500 LB)
- (C) is optimum altitude (40,000 FT)

Read down from initial altitude A to fuel remaining B

Step 2. Determine cruise and descent by comparison.

- (D) is range (172 naut mi) and elapsed time (40.5 min) conditions for cruise and descent obtained from NOTE 1
- (E) is range (255 naut mi) and elapsed time (44.5 min) conditions for cruise and descent obtained from NOTE 2
- (F) is range (287 naut mi) and elapsed time (46.2 min) conditions for cruise and descent obtained from NOTE 3

Step 3. Determine cruise speed.

- (G) is cruise speed (.40 true Mach No.) for initial altitude (10,000 FT)
- (H) is cruise speed (.66 true Mach No.) for optimum altitude (40,000 FT)

Step 4. Determine point from destination at which maximum-range descent is started.

- (J) is distance traveled from optimum altitude to destination (47 naut mi), fuel used (72 LB), and elapsed time (7.0 min) for a maximum - range descent.

39A-1-93-83A

PART 5-DESCENTS

TABLE OF CONTENTS

Titles CAPITALIZED denote charts.

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Descents	A5-1
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DESCENTS

DESCENTS.

Distance, time, fuel consumed, and rate of descent for two types of descents are given in figure A5-1. Charts include minimum time descent with Idle Thrust, speed brake out; and a maximum range descent with Idle Thrust, speed brake closed. An additional chart is provided to enable planning of missions involving penetration descents (figure A5-2).

Maximum descent distance, Idle Thrust, is achieved by maintaining the flattest possible glide angle. It is independent of weight; i.e., an airplane will have the same optimum gliding angle whether empty, partly loaded, or fully loaded. Because of this, distance traveled will be the same regardless of gross weight. To achieve optimum angle of attack for maximum glide distance, increased weight requires higher airspeed. Inasmuch as the glide angle is fixed, the higher airspeed gives increased sink rates and shorter descent time, but the same glide distance. The maximum range descent speed, Idle Thrust, is established by gradually reducing thrust. At the reduced thrust setting, the airplane will decelerate and stabilize at a lower speed. Continuing the process, a speed will be reached where any further reduction in speed requires increased thrust to stabilize. Reduce throttle to Idle Thrust, nose over, and maintain the descent speed constant. Whereas Idle Thrust descents require only a knowledge of airplane drag characteristics, power-on descents require an understanding of the engine performance as well. Tactically, it is a requirement to consistently make good the time-distance-fuel in a power-on descent. Because thrust is a critical factor in descent, it is mandatory that the thrust be accurately established in flight by accounting for the factors which affect thrust: namely, Mach number, altitude, and free air temperature. A thrust meter is the most desirable and direct means for establishing a thrust. Most high-performance aircraft are provided with a thrust meter of some kind. Fuel flow is also a satisfactory means of establishing thrust for the power-on descent. The power-on descent is initiated by reducing the thrust to a specific thrust meter or fuel flow setting. Maintain the altitude until the airplane has decelerated to the desired descent speed (Mach number). At this point, the thrust setting is established and there is no need to bother again with the throttle until the descent is complete. At the desired speed, push over and concentrate only on maintaining the descent speed. An interesting feature of the power-on descent is that initially at high altitudes, the rate of descent is relatively low, building up to a rather high rate just before termination at low altitudes.

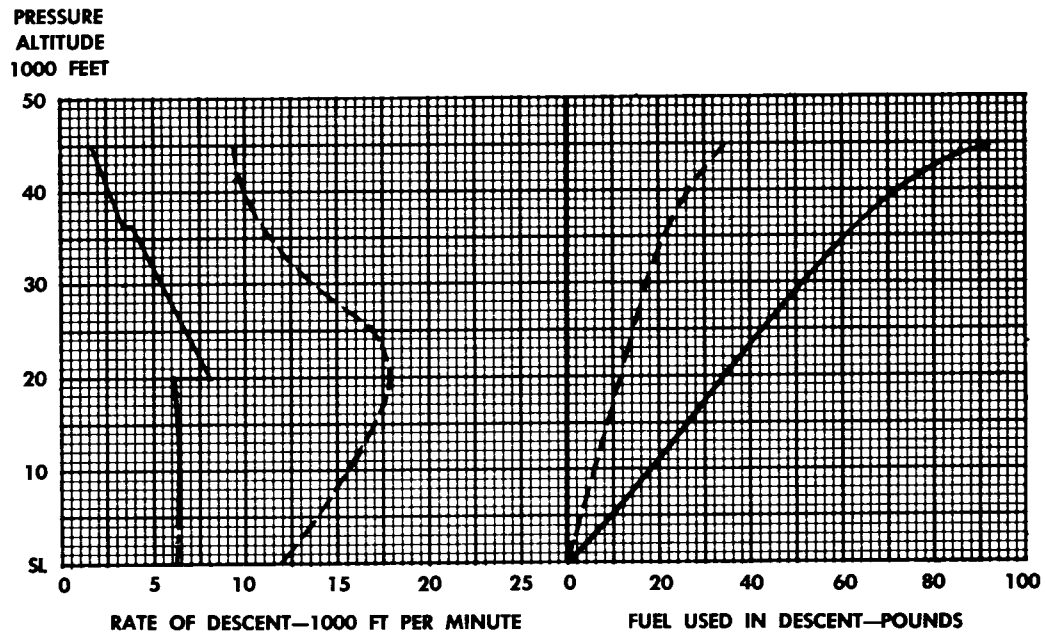
Thrust varies drastically with free air temperature; consequently, rpm should not be used to monitor thrust. Remember, time-fuel-distance in descent can be consistently achieved only by means of either a thrust meter or engine fuel flow.

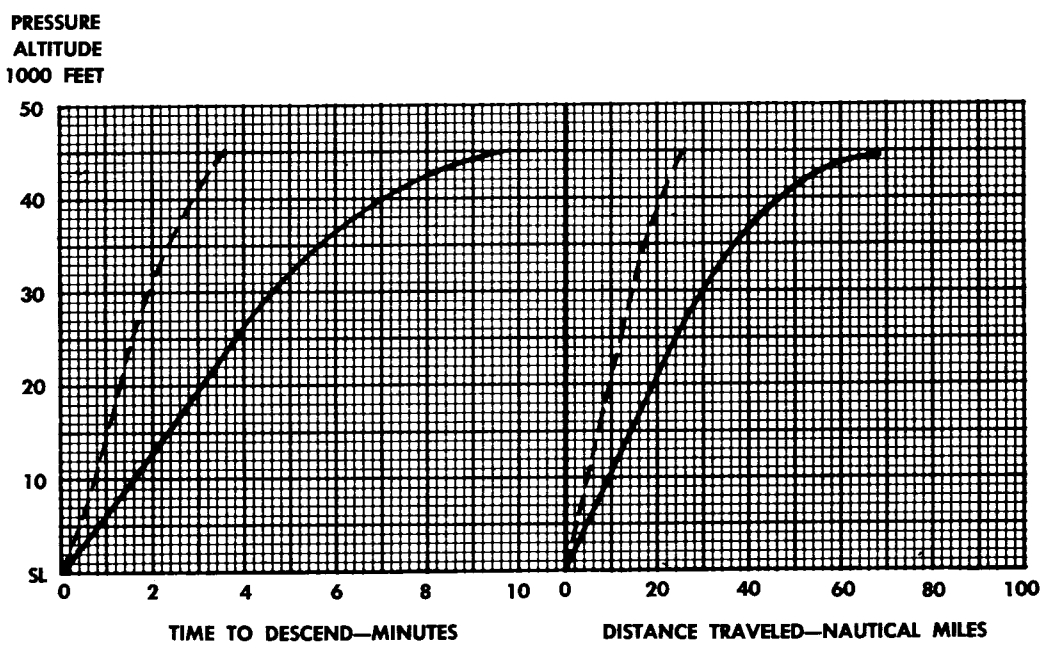
DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23 AND NAA)

DESCENTS

MAXIMUM RANGE OR MINIMUM TIME

MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4





LEGEND

——— MAXIMUM-RANGE DESCENT

— — — MINIMUM-TIME DESCENT

REMARKS

1. MAXIMUM-RANGE DESCENT—USE IDLE THRUST, SPEED BRAKE CLOSED. DESCEND AT .7 MACH NUMBER OR 325 KNOTS IAS, WHICHEVER IS LESS.
2. MINIMUM-TIME DESCENT—USE IDLE THRUST, SPEED BRAKE OPEN. DESCEND AT .765 MACH NUMBER OR 350 KNOTS IAS, WHICHEVER IS LESS.

T-39A-1-93-49A

Figure A5-1

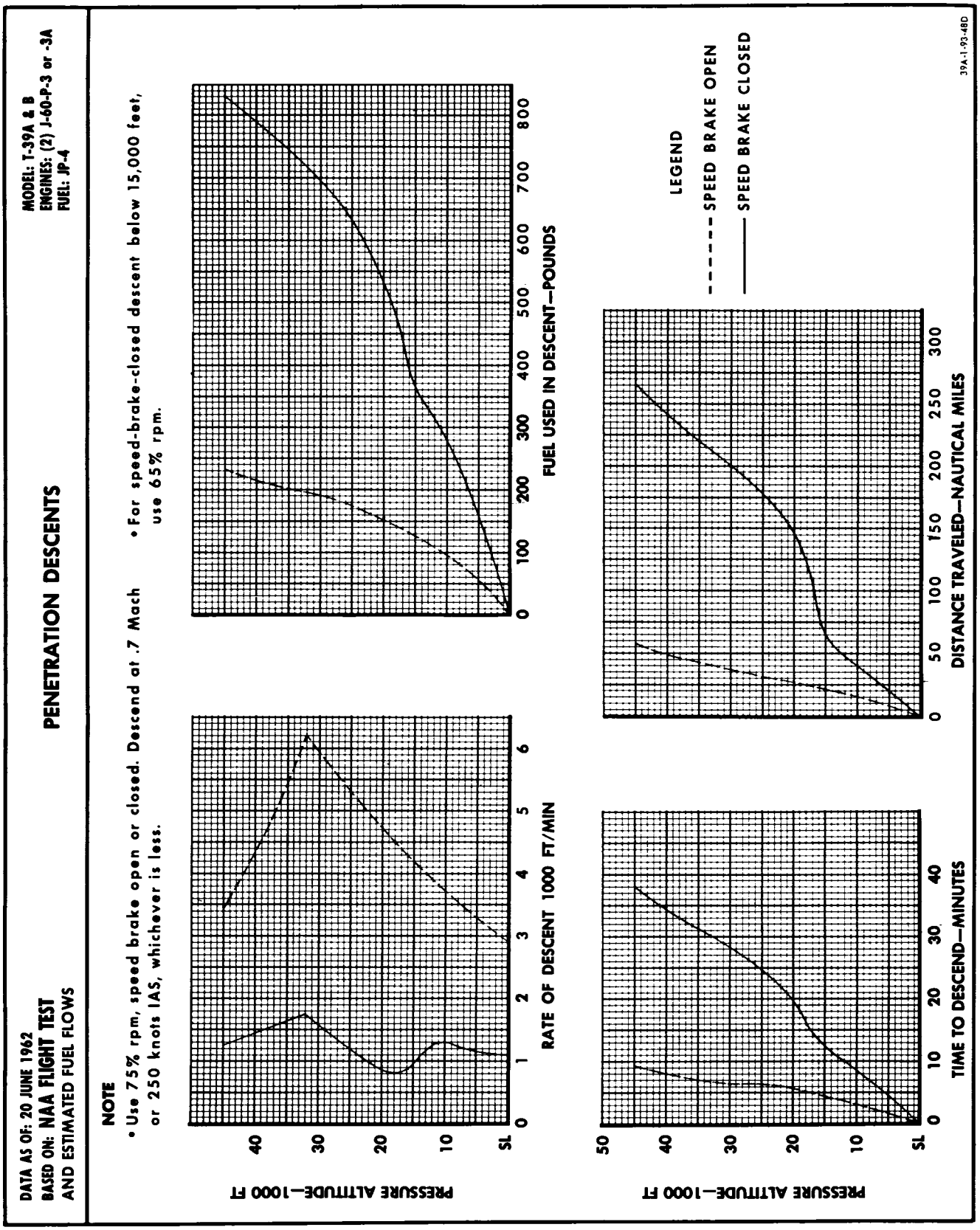

PENETRATION DESCENTS
DATA AS OF: 20 JUNE 1962
BASED ON: NAA FLIGHT TEST
AND ESTIMATED FUEL FLOWS
MODEL: T-39A & B
ENGINES: (2) J-60-P-3 or -3A
FUEL: JP-4
NOTE
• Use 75% rpm, speed brake open or closed. Descend at .7 Mach or 250 knots IAS, whichever is less.
• For speed-brake-closed descent below 15,000 feet, use 65% rpm.
PRESSURE ALTITUDE—1000 FT
RATE OF DESCENT 1000 FT/MIN
FUEL USED IN DESCENT—POUNDS
TIME TO DESCEND—MINUTES
DISTANCE TRAVELED—NAUTICAL MILES
LEGEND
SPEED BRAKE OPEN
SPEED BRAKE CLOSED
39A-1-93-48D

Figure A5-2

PART 6—LANDING

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Titles CAPITALIZED denote chart.

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Landing Distance - Ground Roll	A6-1
LANDING DISTANCES OVER OBSTACLE	A6-2
LANDING DISTANCE - GROUND ROLL	A6-3

LANDING

LANDING DISTANCE OVER OBSTACLE.

NOTE See figure A2-4 for cross-wind landing data.

The landing distance over obstacle chart (figure A6-1) shows the distance required to stop for a recommended landing. The distance as shown is ground-roll distance plus air distance required when landing over a 50-foot obstacle. As this chart is based on full flaps during the entire ground roll, raising the flaps after landing will reduce the distance required to stop. A note on the chart shows the percentage of increase in distance for landings with the speed brake closed, and a percentage decrease in distance when one engine is shut down. Temperature, altitude, gross weight, and runway condition compensations are included.

The final approach speed (required speed to be used at the 50-foot obstacle) for various weights is shown with a note to show approximate touchdown speeds. Approach patterns with extended base or long final approach legs may be flown at increased speeds if mission requirements so dictate. A sample problem demonstrates the use of the chart.

LANDING DISTANCE—GROUND ROLL.

Landing ground-roll distances are shown in figure A6-2 for the recommended landing configuration of flaps down and speed brake open. Temperature, altitude, gross weight, and runway condition compensations are included.

RUNWAY CONDITION.

When other than dry conditions exist on active runways, a correction must be applied to the ground roll distance obtained from the charts. This correction is obtained by using the runway condition grid in the same manner as the wind or runway slope grids. The relative slickness of the runway will be transmitted as part of the teletype weather sequence, appearing as the RCR number. An example on the chart shows how this correction is applied.

NOTE If no RCR number is available, use RCR 12 for wet runways and RCR 5 for icy runways.

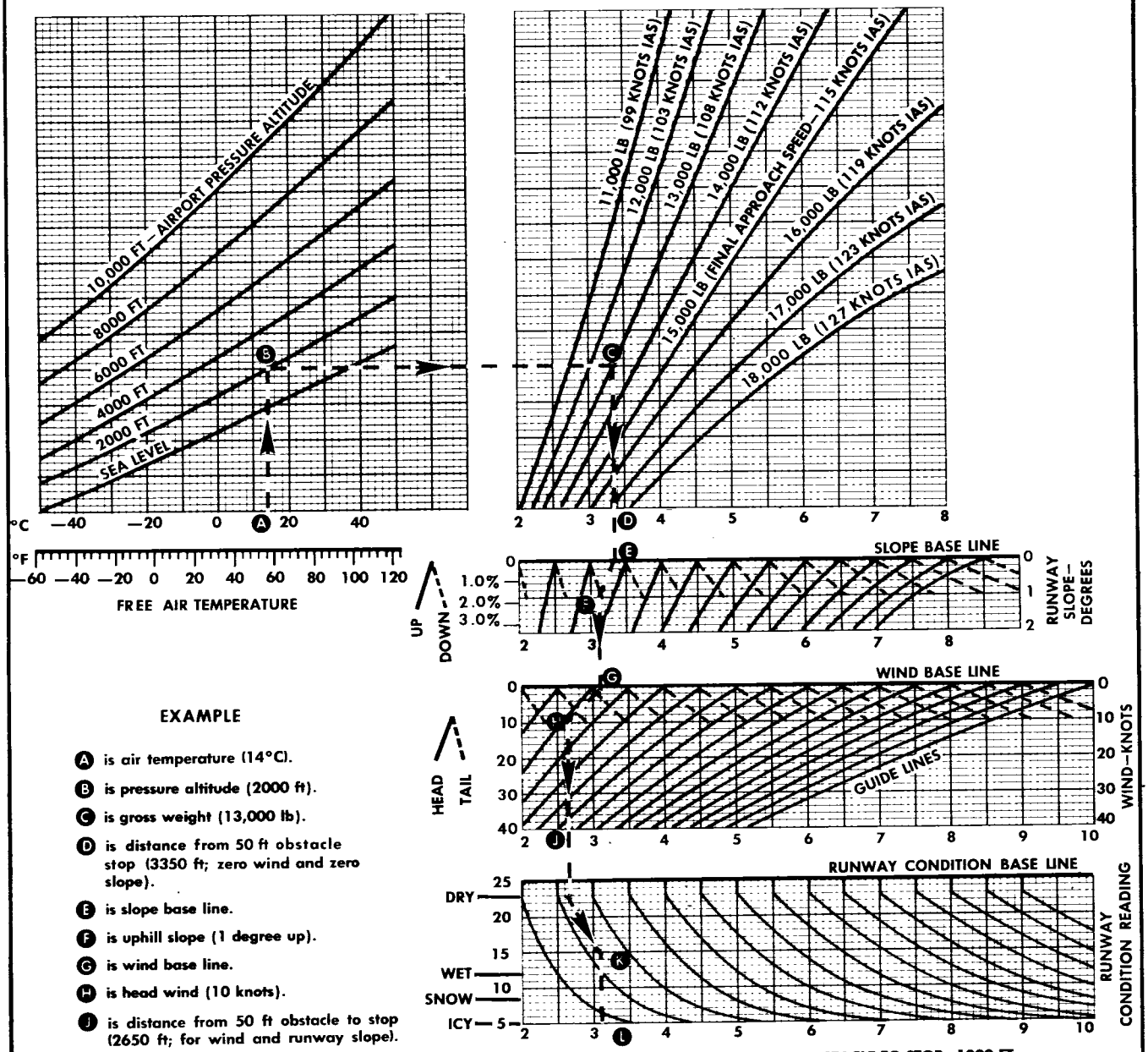
- For ICAO report of good, use RCR 23; for medium, use RCR 12; and for poor, use RCR 5.

DATA AS OF: OCTOBER 1964
BASED ON: **FLIGHT TEST**
(USAF FTC-TDR-64-23, AND NAA)

LANDING DISTANCE—OVER OBSTACLE

FLAPS FULL DOWN—OPTIMUM BRAKING—
SPEED BRAKE OPEN

MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4



EXAMPLE

- (A) is air temperature (14°C).
- (B) is pressure altitude (2000 ft).
- (C) is gross weight (13,000 lb).
- (D) is distance from 50 ft obstacle stop (3350 ft; zero wind and zero slope).
- (E) is slope base line.
- (F) is uphill slope (1 degree up).
- (G) is wind base line.
- (H) is head wind (10 knots).
- (J) is distance from 50 ft obstacle to stop (2650 ft; for wind and runway slope).
- (K) is runway condition (RCR 15).
- (L) is total distance from 50 ft obstacle to stop (3100 ft; for wind, slope, and runway condition).

NOTE

Speed brake closed will increase distance by 6 percent.

Touchdown speed will be approximately 7 knots IAS lower than final approach speed.

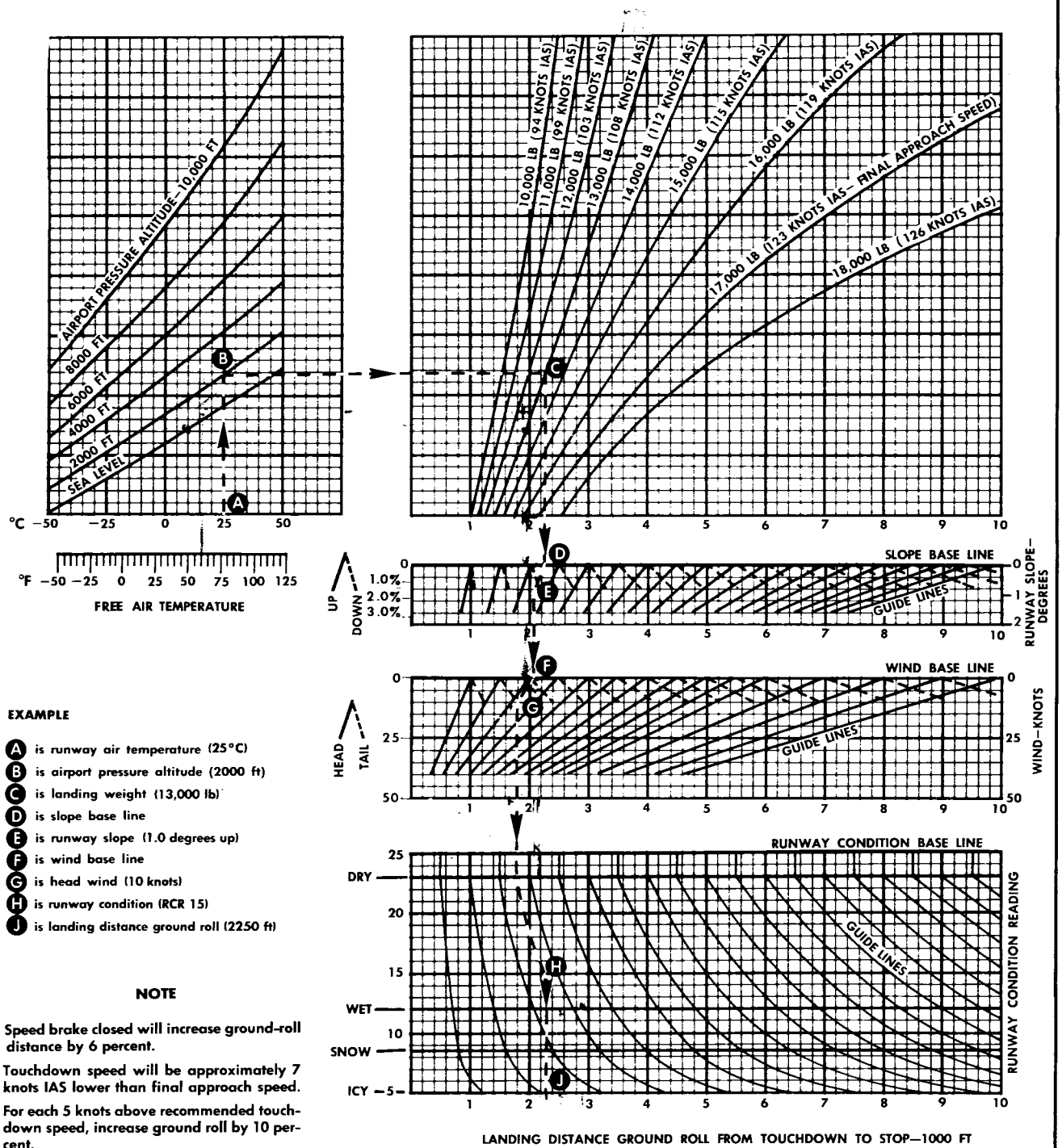
39A-1-93-46G

Figure A6-1

DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23, AND NAA)

LANDING DISTANCE—GROUND ROLL
FLAPS DOWN—OPTIMUM BRAKING— SPEED BRAKE OPEN

MODEL: T-39 A & B
ENGINES: (2) J60-P-3 OR -3A
FUEL: JP-4



EXAMPLE

- (A) is runway air temperature (25°C)
- (B) is airport pressure altitude (2000 ft)
- (C) is landing weight (13,000 lb)
- (D) is slope base line
- (E) is runway slope (1.0 degrees up)
- (F) is wind base line
- (G) is head wind (10 knots)
- (H) is runway condition (RCR 15)
- (J) is landing distance ground roll (2250 ft)

NOTE

- Speed brake closed will increase ground-roll distance by 6 percent.
- Touchdown speed will be approximately 7 knots IAS lower than final approach speed.
- For each 5 knots above recommended touchdown speed, increase ground roll by 10 percent.
- For one-engine ground roll, reduce ground-roll distance by 4 percent.
- For flaps-up ground roll, reduce ground-roll distance by 13 percent.

39A-1-93-2E

Figure A6-2

PART 7-J201 COMPUTER

J201 COMPUTER.

The J201 computer is used to compute P_{t5} for engine thrust setting and as an aid to in-flight planning. The computer is essentially a circular slide rule made of three black and yellow plastic discs. The computer may be used to solve problems of thrust setting, speed and distance, and time. In addition, it may be used to obtain various conversion and correction factors and to perform certain numerical computations. The scales are clearly marked, and instructions are printed on the computer for their use. Figure A7-1 shows the computer and identifies major scales, legends, and indexes.

The interpretation of the scales in one segment is the same for all other segments. The increments on each scale are numbered. The speed and distance scale and the time scale contain values representing 10 to 100. Because these scales are logarithmic, any number may also be used as a multiple of 10. For example, the number 40 may be used as 0.4, 4, 40, 400, 4000, and so on. Examples used in the text are arbitrarily chosen and are only shown to aid in the explanation of an individual function.

P_{t5} ENGINE THRUST COMPUTATION SCALES.

Military Thrust Setting for Take-off.

On the Military Thrust setting for take-off segment, align the actual runway air temperature ("FLD TEMP.") on the "DEG. C." or "DEG. F." scale with airport pressure altitude (thousands of feet) in the "PR. ALT." window. Read required P_{t5} value under the yellow P_{t5} index. (For "PR. ALT." of 1000 feet and "FLD. TEMP." of 20°C, P_{t5} is 58.6 in. Hg.)

NOTE Do not use the temperature gage in the cockpit to obtain the free air temperature on the ground.

Military Thrust Setting - In-flight.

Using the Military Thrust setting - in-flight segment, align the indicated temperature on the "IND. TEMP." scale with the pressure altitude (thousands of feet) in the "PR. ALT." window. Read P_{t5} value in P_{t5} window under indicated Mach on "IND MACH" scale. (For "IND. TEMP." of 0°C, "PR. ALT." 10,000 feet, "IND. MACH." .48, P_{t5} is 51.0 in. Hg.)

Normal Rated Thrust Setting - In-flight.

Use the Normal Rated Thrust setting - in-flight segment in the same manner as described under "Military Thrust Setting - In-flight."

MISCELLANEOUS SCALES.

True Mach and Airspeed.

Using the true Mach segment, align calibrated pressure altitude (thousands of feet) on the "CAL. PR. ALTITUDE" scale with indicated airspeed on "INDICATED AIRSPEED" scale. Without moving computer disc, read true Mach at "TRUE MACH" index.

NOTE With the same disc setting, read altimeter error for this altitude and airspeed in the "ALTITUDE CORRECTION SCALES" window opposite selected pressure altitude. Fly an indicated altitude which is higher by the amount of this correction.

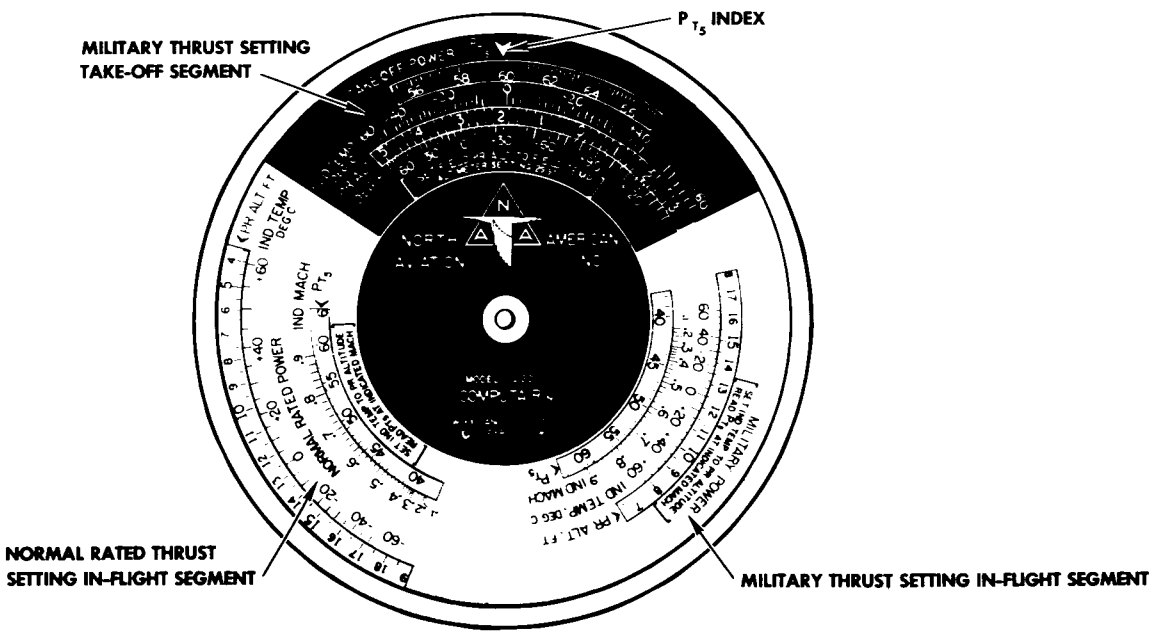
Now align indicated air temperature on "INDICATED AIR TEMP." scale (degrees C) with true Mach on yellow "TRUE MACH" scale. Read true airspeed in knots above the time/true airspeed ("KTS. T.A.S.") index. (For "CAL. PR. ALTITUDE" of 35,000 feet, IAS of 220 knots, true Mach is .654 and altimeter correction to be subtracted is 89 feet. For indicated air temperature of -35°C, TAS is 383 knots.)

Static and Total Temperature.

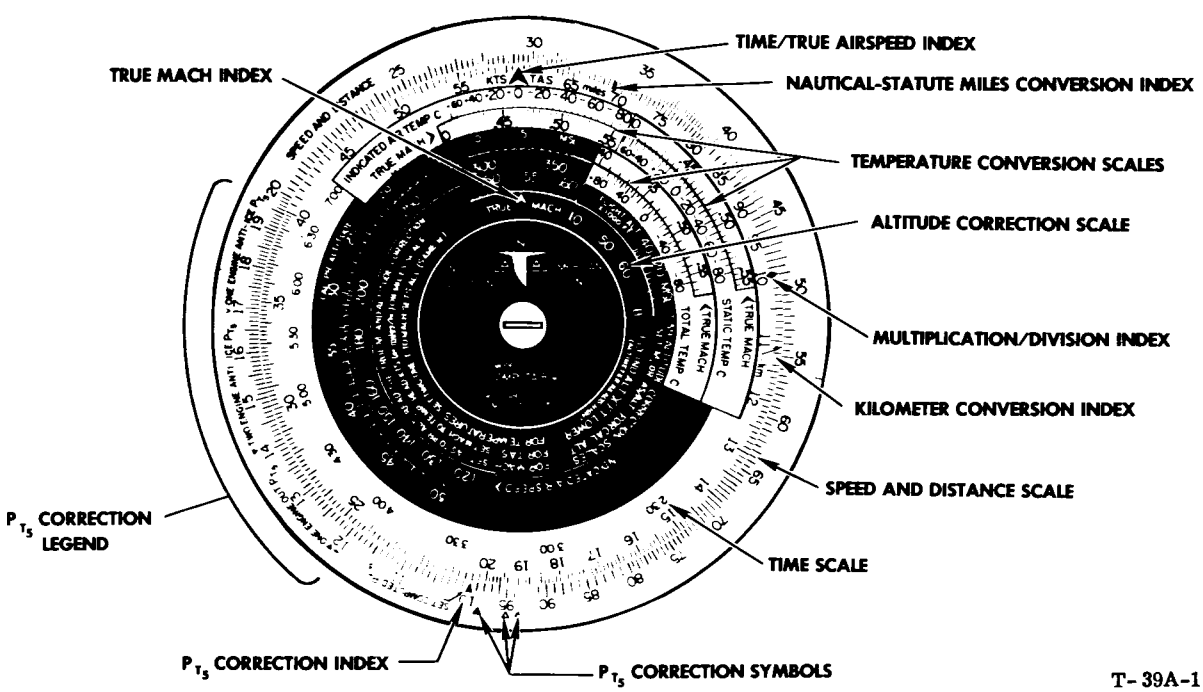
With "TRUE MACH" and "INDICATED AIR TEMP." scales lined up, static and total temperature are read for the same true Mach on the appropriate scale. Static temperature is the actual outside air temperature. Total temperature is

J201 COMPUTER

P_{T_5} ENGINE THRUST COMPUTATION SCALES



MISCELLANEOUS SCALES



T-39A-1-93-47

Figure A7-1

the air temperature corrected for ram effect at any of the airplane's leading surfaces, for example, the engine inlet ducts or the wing leading edges. (For true Mach of .654 and indicated air temperature of -35°C, static temperature is 46°C, and total temperature is -27°C.)

P_{t5} Corrections.

To determine the correct P_{t5} setting for single-engine operation or during anti-ice system operation, set previously computed take-off or in-flight P_{t5} beneath the P_{t5} correction index (10) on the speed and distance scale. Using P_{t5} correction legend to the right of index, determine the appropriate configuration symbol to be used. To the left of the P_{t5} correction index beneath the appropriate symbol will be the maximum P_{t5} for that configuration. (For computed P_{t5} of 47.5 in. Hg and two-engine anti-ice operation, maximum P_{t5} is 45.1 in. Hg.)

Speed and Distance.

Speed per hour is obtained by aligning distance traveled with time elapsed and reading speed opposite the time/true-airspeed index. To compute distance traveled for any given length of time, align the time/true airspeed ("KTS. T.A.S.") index with speed per hour on "SPEED AND DISTANCE" scale. Read distance traveled above minutes (hours) elapsed. At a speed of 385 knots for 180 minutes (3:00 hours), distance is 1155 nautical miles.

Miles to Knots.

Align nautical-statute miles conversion index with known statute miles or miles per hour on "SPEED AND DISTANCE" scale. Read nautical miles or knots opposite the time/true-airspeed ("KTS. T.A.S.") index. To convert from nautical miles or knots to statute miles or miles per hour, align the time/true-airspeed index with knots and read the statute values opposite miles conversion index.

Kilometer Conversion Index.

The kilometer conversion index is used in the identical manner as described for the nautical-statute miles conversion index. With the kilometer index aligned with known kilometers, statute or nautical miles may be read opposite the appropriate index.

Multiplication.

Align the multiplication/division index of the time scale with the number to be multiplied. Read the product on the "SPEED AND DISTANCE" scale above the multiplier on the time scale.

Division.

Align the dividend of the "SPEED AND DISTANCE" scale with the divisor on the time scale. The multiplication/division index will align with the quotient on the "SPEED AND DISTANCE" scale. Division has a practical application in determining fuel flow, using the formula TAS divided by NAUTICAL MILES PER POUND OF FUEL equals POUNDS PER HOUR FUEL FLOW. For example: Find 400 (TAS) on "SPEED AND DISTANCE" scale. Set .25 (nautical miles/pound fuel) on time scale opposite 400 of "SPEED AND DISTANCE" scale. Read 1600 opposite multiplication/division index which is the total pounds-per-hour fuel flow. (Each fuel flow indicator should read 800 pounds per hour.)

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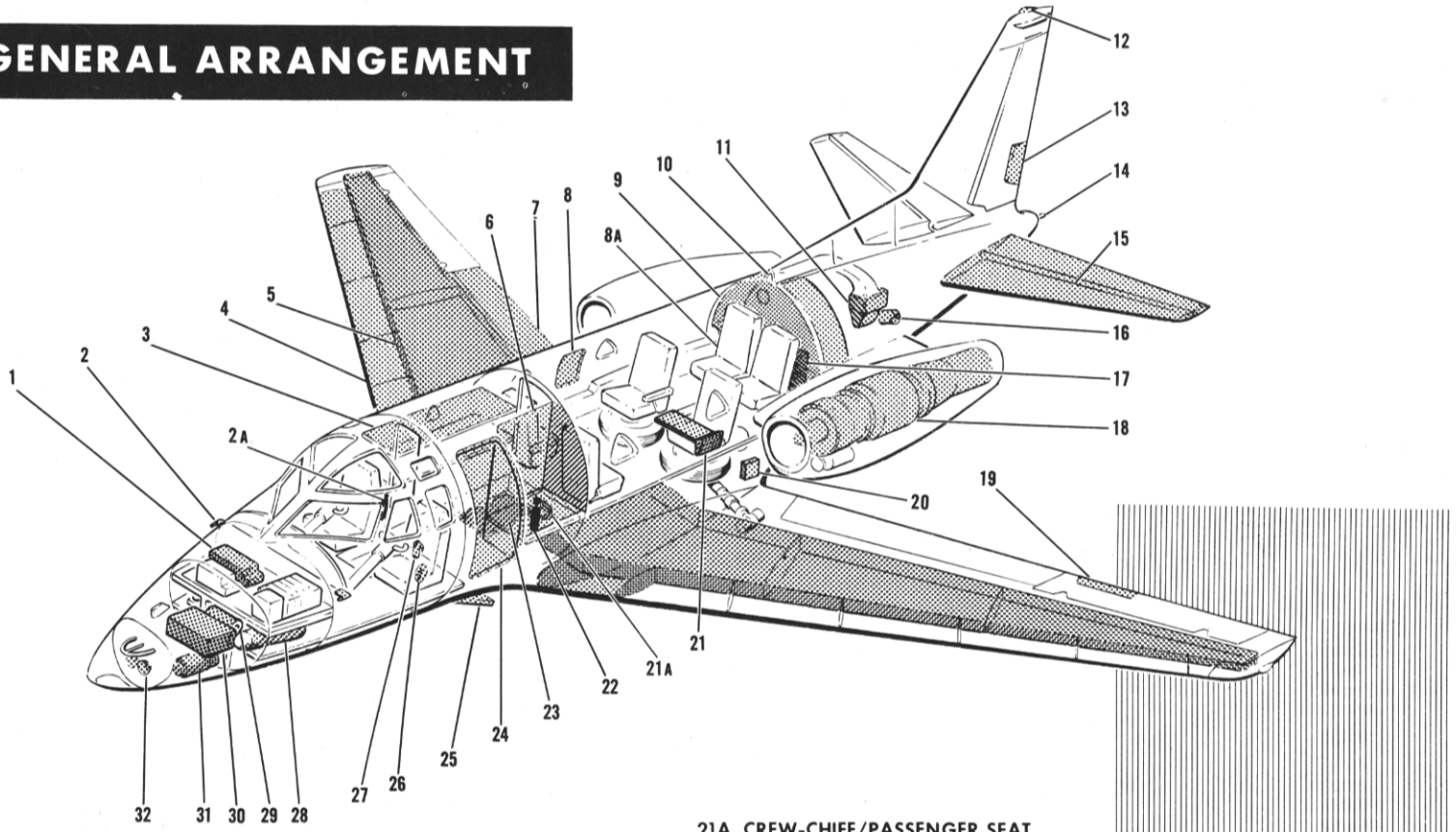
GENERAL ARRANGEMENT



1. RADIO EQUIPMENT
2. PITOT HEAD (TYPICAL BOTH SIDES)
2A. WALK-AROUND OXYGEN BOTTLE †
3. BAGGAGE COMPARTMENT
4. WING SLATS
5. INTEGRAL WING FUEL TANKS
6. COAT COMPARTMENT †
7. WING FLAPS
8. GROUND ESCAPE HATCH
8A. TWO-PASSENGER/BAGGAGE SEAT †
9. FUSELAGE FUEL CELL
10. RAM-AIR INLET
11. HEAT EXCHANGER
12. ANTICOLLISION LIGHT
13. RUDDER TRIM TAB
14. FUEL JETTISON AND VENT
15. TRIMMABLE HORIZONTAL STABILIZER
16. HYDRAULIC RESERVOIR
17. BATTERIES (TWO)
18. J60 TURBOJET ENGINE (TYPICAL BOTH SIDES)
19. AILERON TRIM TAB
20. DC EXTERNAL POWER RECEPTACLES
21. NAVIGATOR'S TABLE AND INSTRUMENTS†
21A. CREW-CHIEF/PASSENGER SEAT WITH CHEMICAL TOILET †
22. WALK-AROUND OXYGEN BOTTLE †
23. IN-FLIGHT ESCAPE HATCH
24. ENTRANCE DOOR
25. SPEED BRAKE
26. WING ICE CHECK LIGHT (TYPICAL BOTH SIDES)
27. HAND FIRE EXTINGUISHER
28. OXYGEN CYLINDER
29. STAND-BY INVERTER
30. TACAN EQUIPMENT
31. MAIN INVERTER
32. LANDING AND TAXI LIGHTS

†Some airplanes. (Refer to applicable text.)

Figure 1-1

COCKPIT—FORWARD VIEW (TYPICAL)

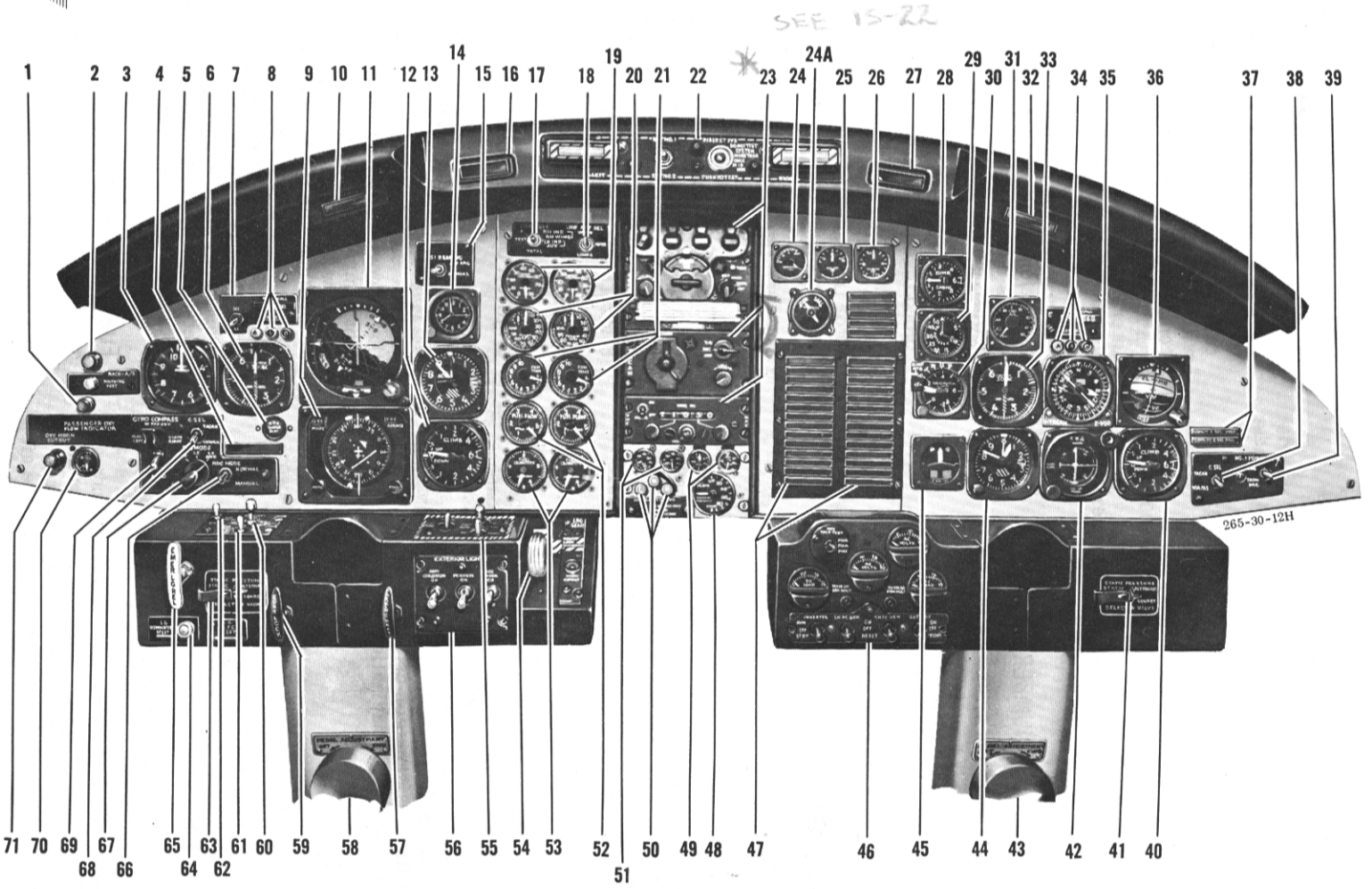


Figure 1-2

1. Passengers' oxygen flow indicator light
2. Mach-airspeed warning test button
3. Mach indicator
4. Course select fail light
5. Compass slaving indicator
6. Airspeed indicator
7. Marker beacon sensitivity switch
8. Marker beacon lights
9. Horizontal situation indicator
10. Nose wheel steering-on indicator light
11. Attitude director indicator
12. Vertical velocity indicator
13. Altimeter
14. Clock
15. HSI bearing selector switch†
16. Master caution light
17. Fuel quantity switch
18. Antenna selector switch
19. Exhaust total pressure gages
20. Tachometers
21. Exhaust gas temperature gages
22. Fire emergency control panel
23. Radio control panels
24. Horizontal stabilizer trim position indicator
24A. Engine syncronization indicator †
25. Rudder trim tab position indicator
26. Aileron trim tab position indicator
27. Master caution light
28. Cabin pressure rate-of-change indicator
29. Cabin altimeter and differential-pressure indicator
30. Accelerometer
31. Free air temperature indicator
32. Nose wheel steering-on indicator light
33. Airspeed indicator
34. Marker beacon lights
35. Bearing-distance-heading indicator
36. Attitude indicator

† Some airplanes. (Refer to applicable text.)

37. Course select inoperative and fail lights
38. Copilot's course selector switch
39. No. 1 pointer selector switch†
40. Vertical velocity indicator
41. Copilot's static-pressure selector
42. Course indicator
43. Copilot's rudder pedal adjustment knob
44. Altimeter
45. Turn-and-slip indicator
46. Electrical indicator and control panel
47. Caution-warning light panel
48. Wing flap position indicator
49. Hydraulic pressure gages
50. Landing gear position lights
51. Oil pressure gages
52. Fuel flow indicators
53. Fuel quantity gages
54. Landing gear control panel
55. Alternate trim control panel
56. Exterior lighting control panel
57. Parking brake "T" handle
58. Pilot's rudder pedal adjustment knob
59. Gust lock "T" handle
60. Speed brake emergency dump switch
61. Horizontal stabilizer trim limit test switch
62. Signal data recorder switch†
63. Pilot's static-pressure selector
64. Landing gear electric reset button
65. Landing gear emergency release "T" handle
66. Heading mode selector switch
67. Flight director mode switch
68. Pilot's course selector switch
69. Gyrocompass mode switch
70. Oxygen cylinder pressure gage
71. Oxygen warning horn cutout button

39A-1-00-17K

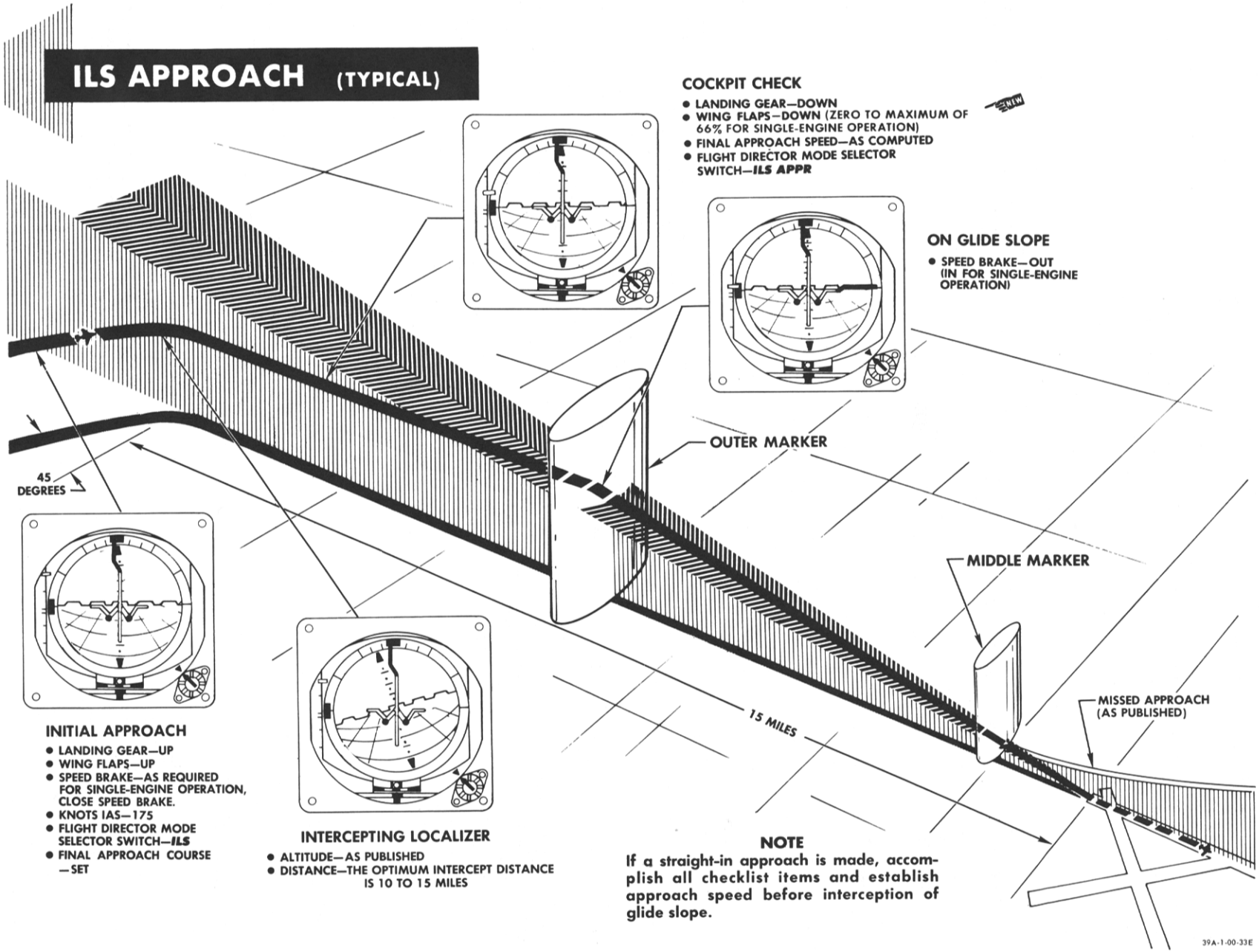

ILS APPROACH (TYPICAL)
COCKPIT CHECK
• LANDING GEAR—DOWN
• WING FLAPS—DOWN (ZERO TO MAXIMUM OF 66% FOR SINGLE-ENGINE OPERATION)
• FINAL APPROACH SPEED—AS COMPUTED
• FLIGHT DIRECTOR MODE SELECTOR SWITCH—ILS APPR
NEW
ON GLIDE SLOPE
• SPEED BRAKE—OUT (IN FOR SINGLE-ENGINE OPERATION)
OUTER MARKER
45 DEGREES
MIDDLE MARKER
MISSED APPROACH (AS PUBLISHED)
15 MILES
INITIAL APPROACH
• LANDING GEAR—UP
• WING FLAPS—UP
• SPEED BRAKE—AS REQUIRED FOR SINGLE-ENGINE OPERATION, CLOSE SPEED BRAKE.
• KNOTS IAS—175
• FLIGHT DIRECTOR MODE SELECTOR SWITCH—ILS
• FINAL APPROACH COURSE —SET
INTERCEPTING LOCALIZER
• ALTITUDE—AS PUBLISHED
• DISTANCE—THE OPTIMUM INTERCEPT DISTANCE IS 10 TO 15 MILES
NOTE
If a straight-in approach is made, accomplish all checklist items and establish approach speed before interception of glide slope.
39A-1-00-33E

Figure 9-3

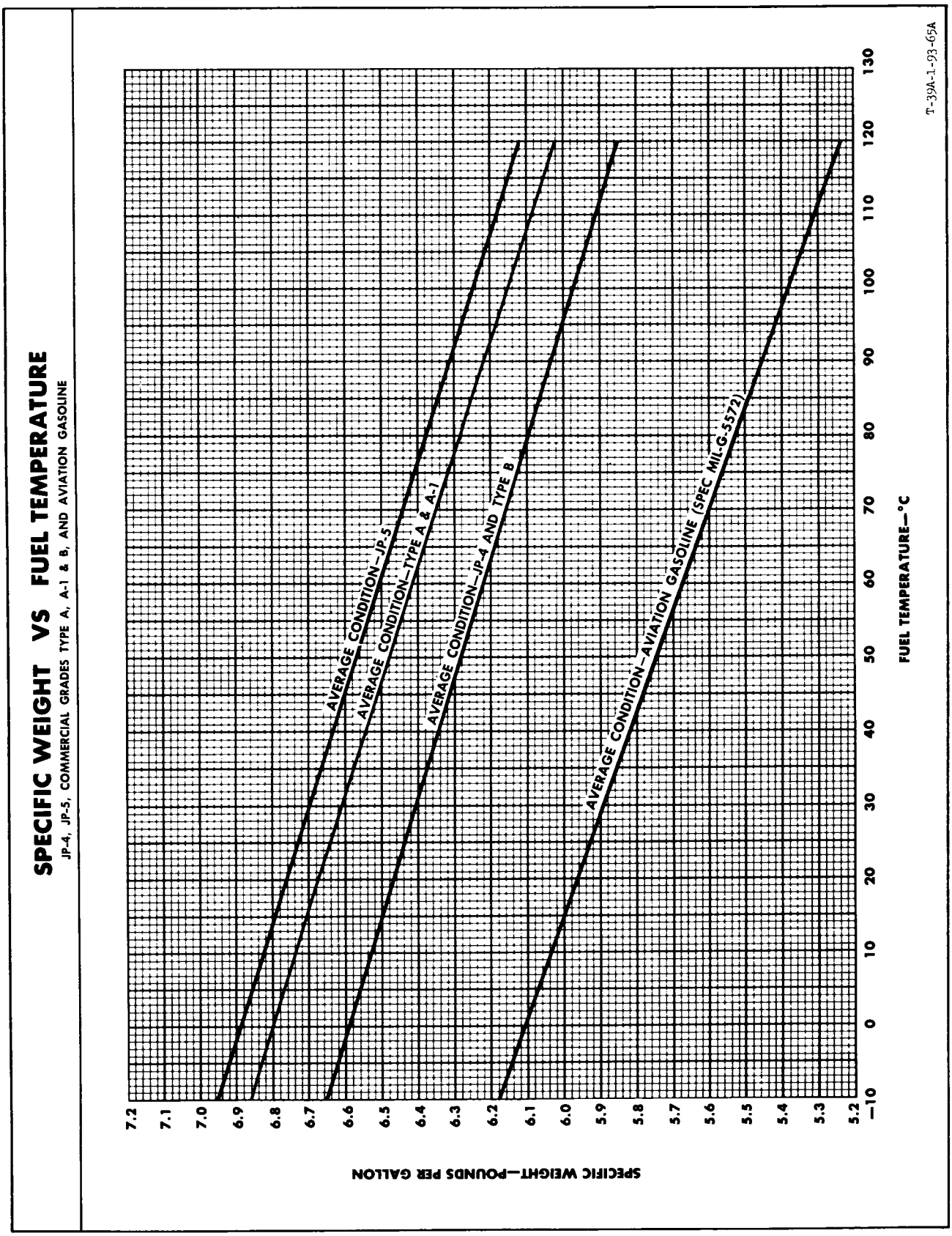

SPECIFIC WEIGHT VS FUEL TEMPERATURE
JP-4, JP-5, COMMERCIAL GRADES TYPE A, A-1 & B, AND AVIATION GASOLINE
T-39A-1-93-65A
AVERAGE CONDITION—JP-5
AVERAGE CONDITION—TYPE A & A-1
AVERAGE CONDITION—JP-4 AND TYPE B
AVERAGE CONDITION—AVIATION GASOLINE (SPEC MIL-G-5572)
SPECIFIC WEIGHT—POUNDS PER GALLON
7.2
7.1
7.0
6.9
6.8
6.7
6.6
6.5
6.4
6.3
6.2
6.1
6.0
5.9
5.8
5.7
5.6
5.5
5.4
5.3
5.2
—10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
FUEL TEMPERATURE—°C

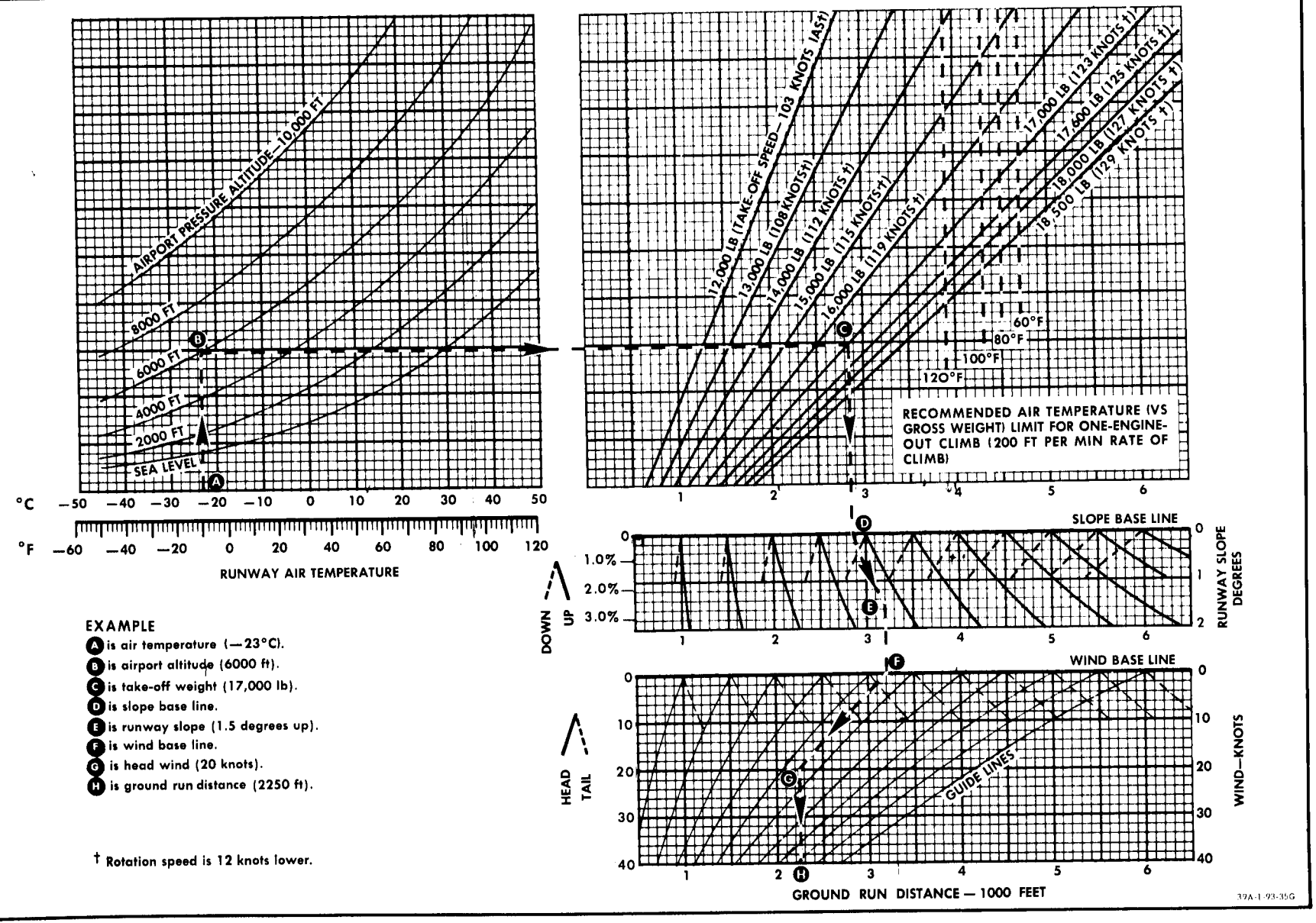
Figure A1-5

DATA AS OF: OCTOBER 1964
BASED ON: **FLIGHT TEST**
(USAF FTC-TDR-64-23, AND NAA)

TAKE-OFF GROUND RUN

TWO ENGINES—FLAPS UP

MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4



EXAMPLE

- (A) is air temperature (—23°C).
- (B) is airport altitude (6000 ft).
- (C) is take-off weight (17,000 lb).
- (D) is slope base line.
- (E) is runway slope (1.5 degrees up).
- (F) is wind base line.
- (G) is head wind (20 knots).
- (H) is ground run distance (2250 ft).

† Rotation speed is 12 knots lower.

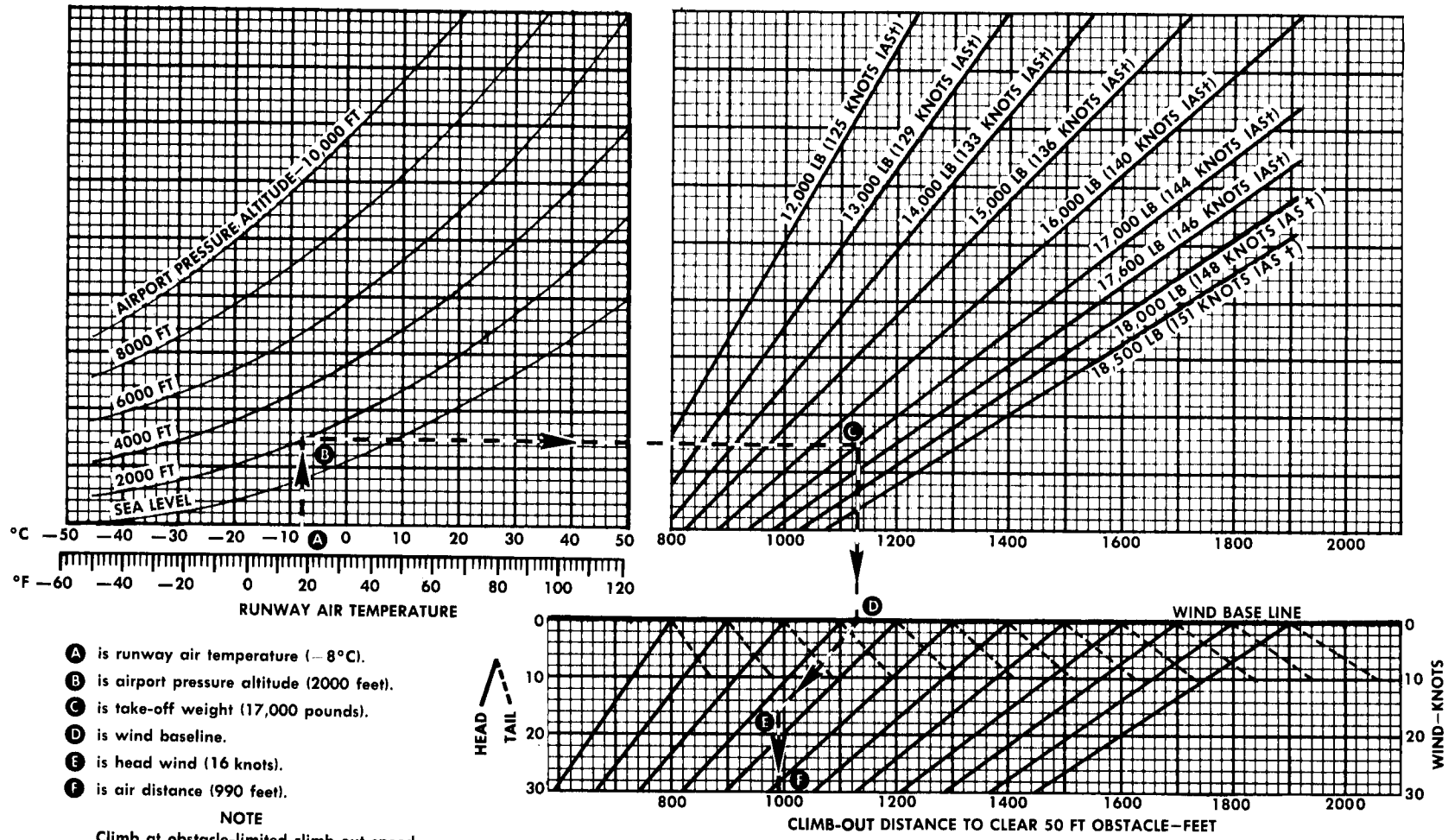
Figure A2-6

DATA AS OF: OCTOBER 1964
BASED ON: **FLIGHT TEST**
(USAF FTC-TDR-64-23, AND NAA)

CLIMB-OUT DISTANCE—TWO ENGINES FROM LIFT-OFF TO CLEAR 50 FT OBSTACLE

MILITARY THRUST—FLAPS UP

MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4



- (A) is runway air temperature (−8°C).
- (B) is airport pressure altitude (2000 feet).
- (C) is take-off weight (17,000 pounds).
- (D) is wind baseline.
- (E) is head wind (16 knots).
- (F) is air distance (990 feet).

NOTE

Climb at obstacle-limited climb-out speed until clear of obstruction.

† Obstacle-limited climb-out speed

39A-1-93-38D

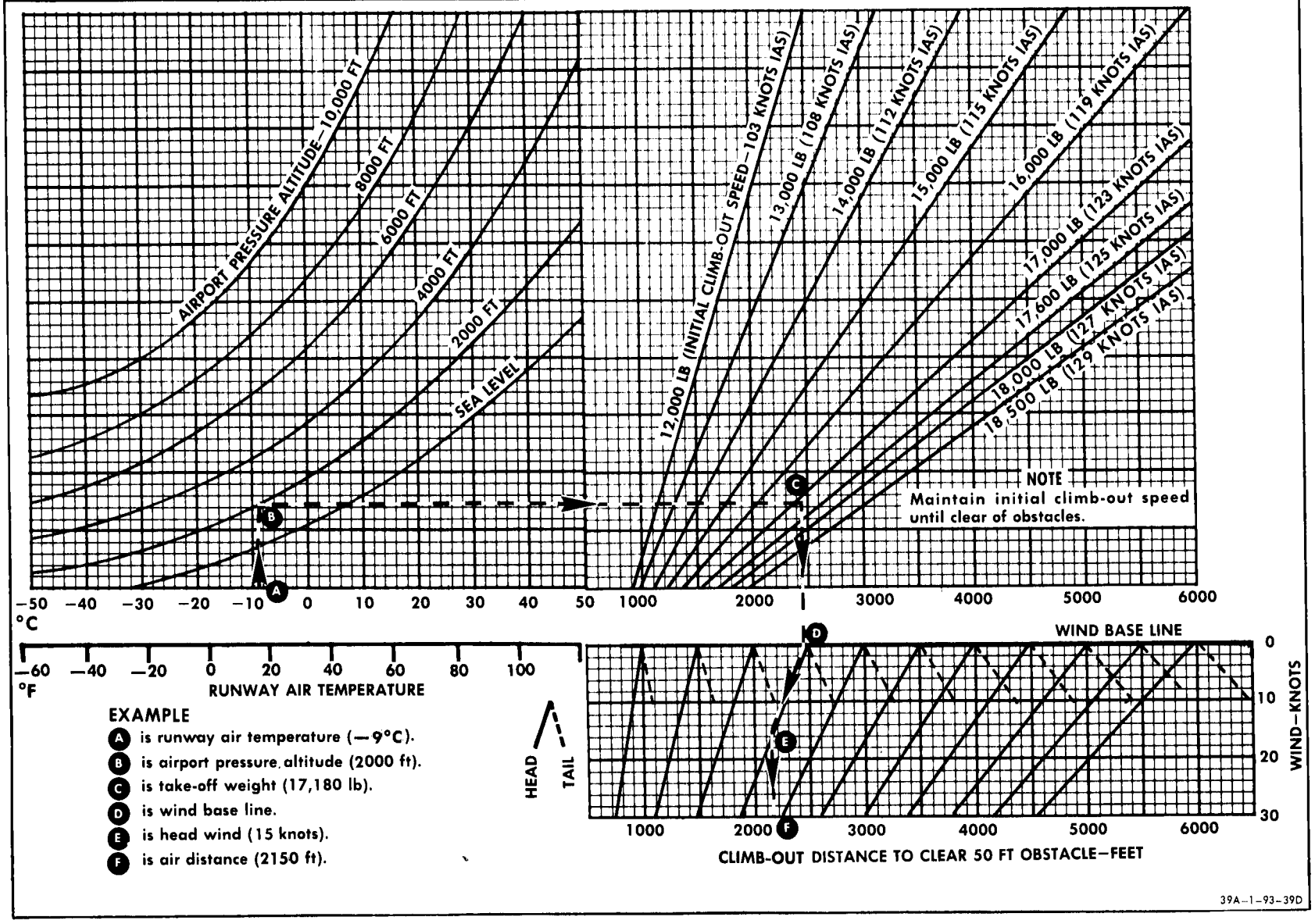
Figure A2-9

DATA AS OF: OCTOBER 1964
BASED ON: **FLIGHT TEST**
(USAF FTC-TDR-64-23, AND NAA)

CLIMB-OUT DISTANCE—ONE ENGINE FROM LIFT-OFF TO CLEAR 50 FT OBSTACLE

MILITARY THRUST—FLAPS UP

MODEL: T-39A & B
ENGINE: J60-P-3 or -3A
FUEL: JP-4



EXAMPLE

- (A) is runway air temperature (−9°C).
- (B) is airport pressure altitude (2000 ft).
- (C) is take-off weight (17,180 lb).
- (D) is wind base line.
- (E) is head wind (15 knots).
- (F) is air distance (2150 ft).

Figure A2-10

STANDARD DAY
DATA AS OF: OCTOBER 1964
BASED ON: **FLIGHT TEST**
(USAF FTC-TDR-64-23, AND NAA)

MILITARY THRUST CLIMB—TWO ENGINES

270 KNOTS IAS OR .68 INDICATED MACH

MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4

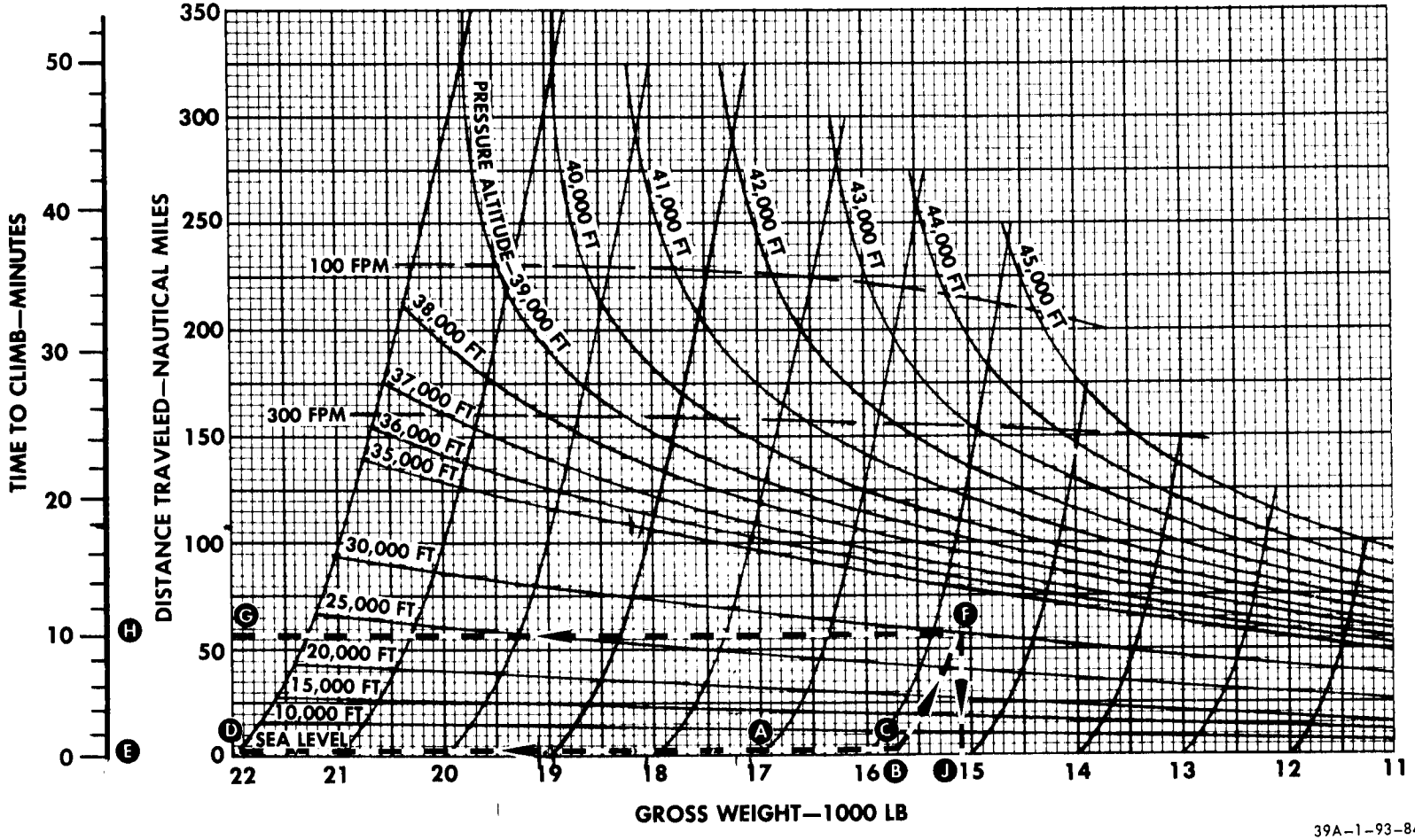
NOTE

For sample problem, see "Climb" text.

NOTE

For each 10°C above Standard Day temperatures, add 1300 pounds to gross weight before using chart.

For each 10°C below Standard Day temperatures, subtract 1300 pounds from gross weight before using chart.



STANDARD DAY
DATA AS OF: OCTOBER 1964
BASED ON: **FLIGHT TEST**
(USAF FTC-TDR-64-23, AND NAA)

MILITARY THRUST CLIMB—ONE ENGINE

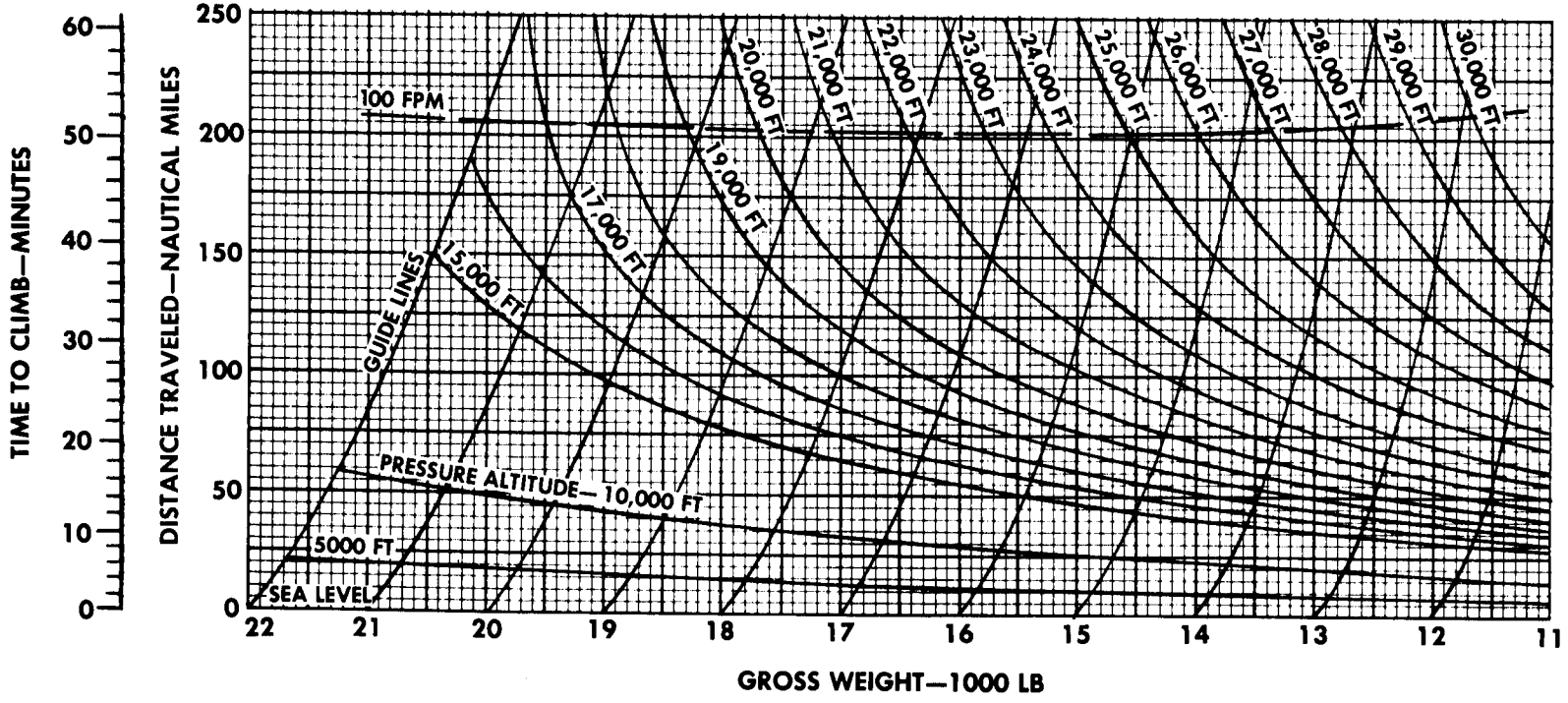
180 KNOTS IAS

MODEL: T-39A & B
ENGINE: J60-P-3 or -3A
FUEL: JP-4

NOTE

For each 10°C above Standard Day temperatures, add 1100 pounds to gross weight before using chart.

For each 10°C below Standard Day temperatures, subtract 1100 pounds from gross weight before using chart.



NOTE

For sample problem, see "Climb" text.

39A-1-93-85

Figure A3-2

STANDARD DAY
DATA AS OF: OCTOBER 1964
BASED ON: **FLIGHT TEST**
(USAF FTC-TDR-64-23, AND NAA)

NORMAL RATED THRUST CLIMB—TWO ENGINES

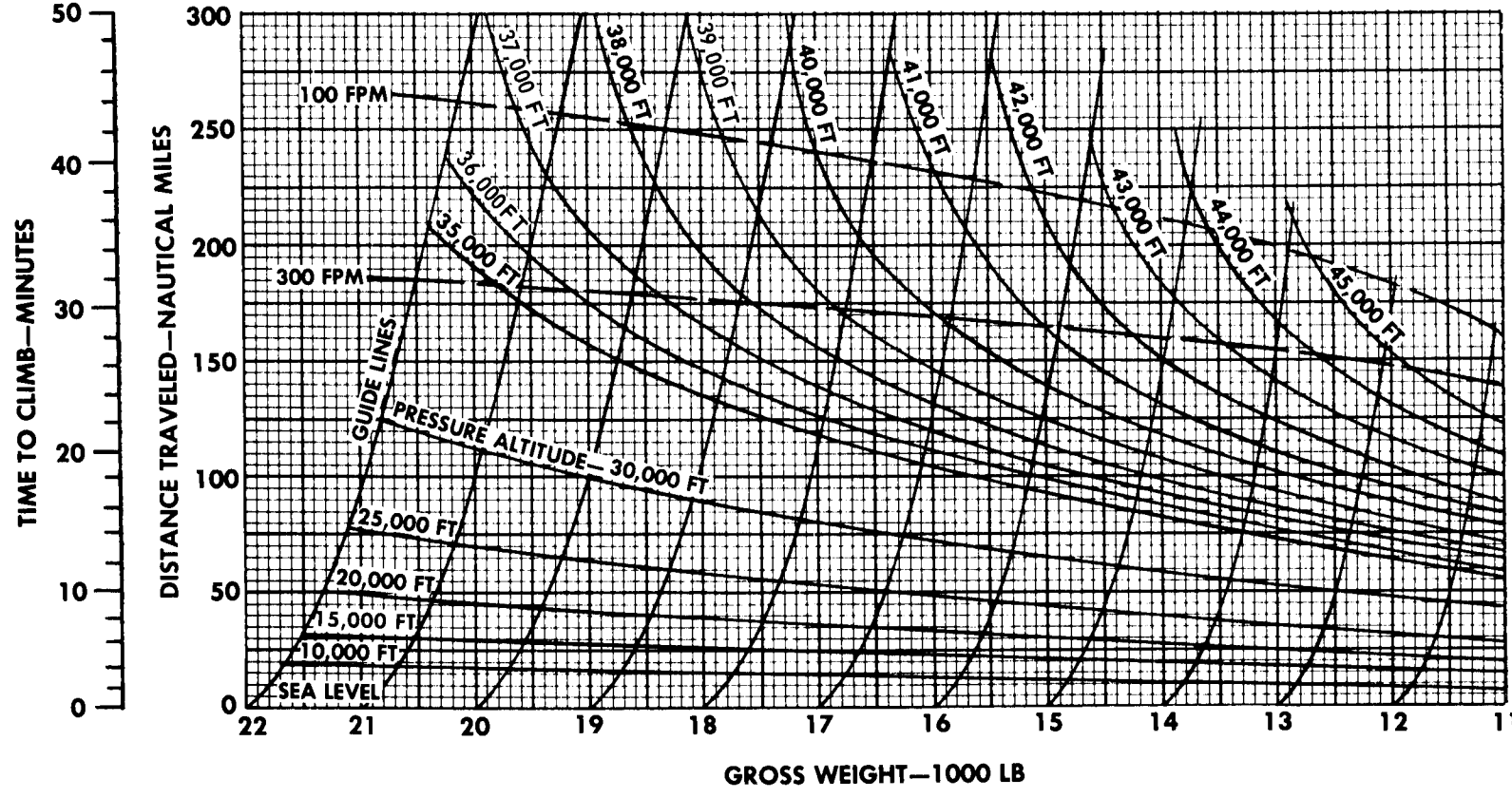
240 KNOTS IAS OR .64 INDICATED MACH

MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4

NOTE

For each 10°C above Standard Day temperatures, add 1700 pounds to gross weight before using chart.

For each 10°C below Standard Day temperatures, subtract 1700 pounds from gross weight before using chart.



39A-1-93-86

Figure A3-3

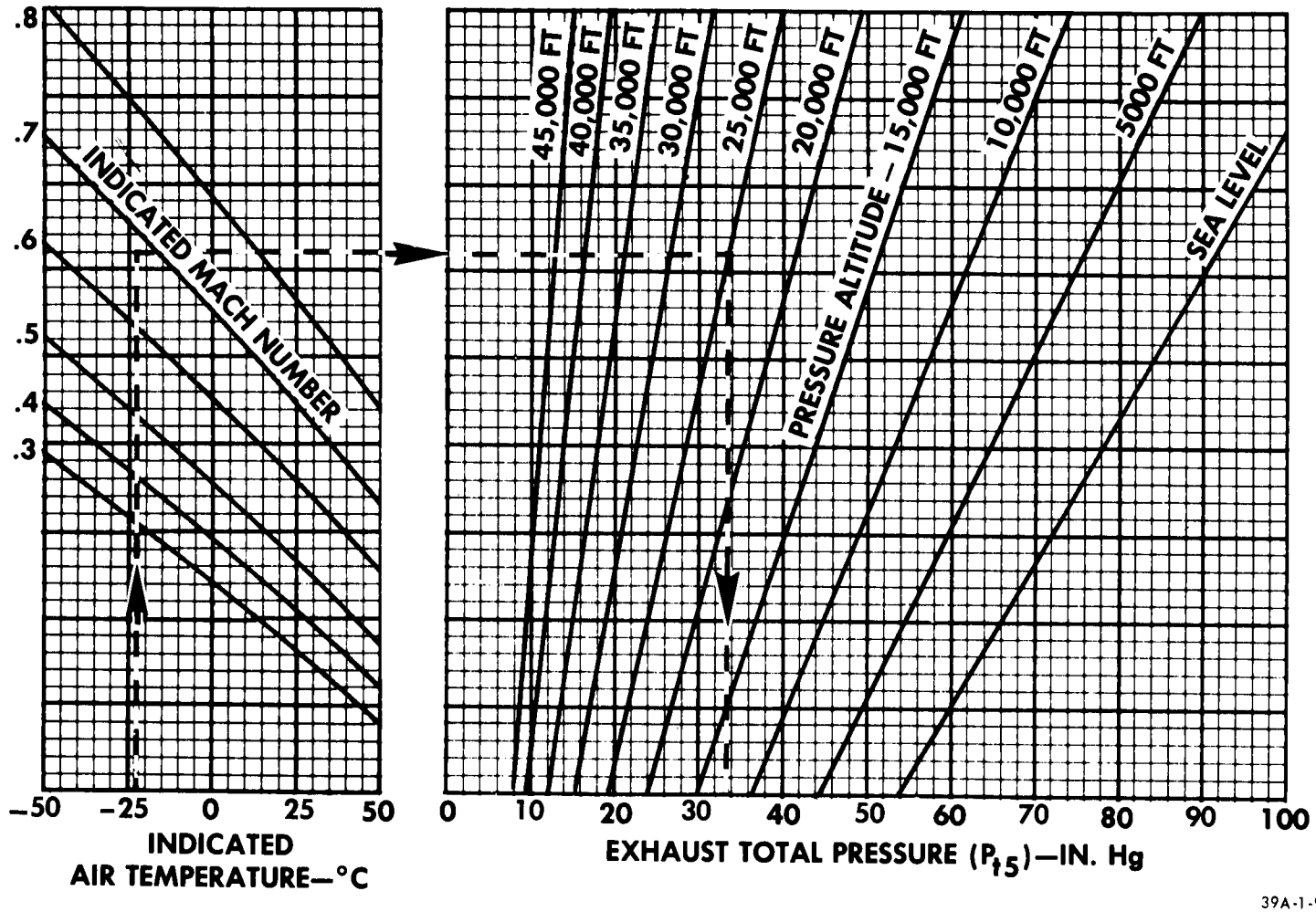
DATA AS OF: OCTOBER 1964
BASED ON: **FLIGHT TEST**
(USAF FTC-TDR-64-23, AND NAA)

MILITARY THRUST SETTINGS IN FLIGHT

MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4

NOTE

- With engine inlet anti-icing on, reduce chart values by 5%. EXAMPLE: 33.5 — (0.05 × 33.5) = 31.8
- For single-engine operation, reduce chart values by 1.5%. EXAMPLE: 33.5 — (0.015 × 33.5) = 33.0



39A-1-93-44C

Figure A3-5

DATA AS OF: OCTOBER 1964

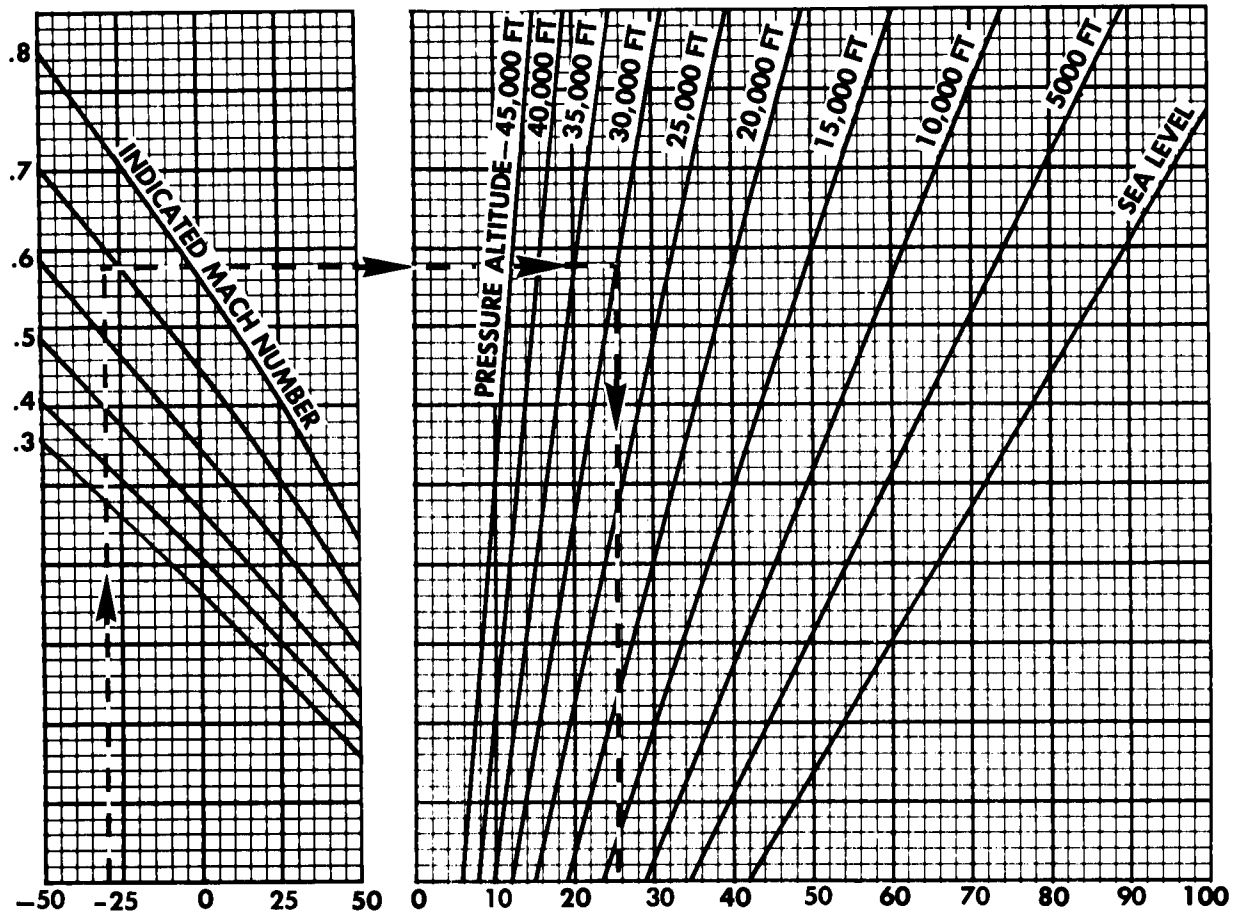
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23, AND NAA)

NORMAL RATED THRUST SETTINGS – IN-FLIGHT

MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4

NOTE

- With engine inlet anti-icing on, reduce chart values by 5%.
- For single-engine operation, reduce chart values by 1.5%.



39A-1-93-45C

Figure A3-6

DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23 AND NAA)

OPERATIONAL RANGE PROFILE

MAXIMUM GROSS WEIGHT—17,760 LB
(AIRPLANES NOT CHANGED BY T.O. 1T-39A-549) NEW

MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4

NOTE

1. Fuel allowance of 380 pounds for start, taxi, take-off, and acceleration to climb speed schedule included.
2. Use Military Thrust for climb.
3. Cruise-climb at Normal Rated Thrust and .76 Mach number.
4. Cruise at recommended Mach number.

CRUISE-CLIMB PATH

POUNDS OF FUEL USED

TOTAL ELAPSED TIME

CRUISE DATA				
ALTITUDE	MACH	CAS	TAS	FUEL FLOW LB/HR
CRUISE-CLIMB	.76		436	1660-1220
40,000	.73	215	417	1570-1230
30,000	.63	235	370	1660-1300
20,000	.54	246	330	1850-1520
10,000	.48	265	310	2200-1870
SEA LEVEL	.45	300	300	2740-2470

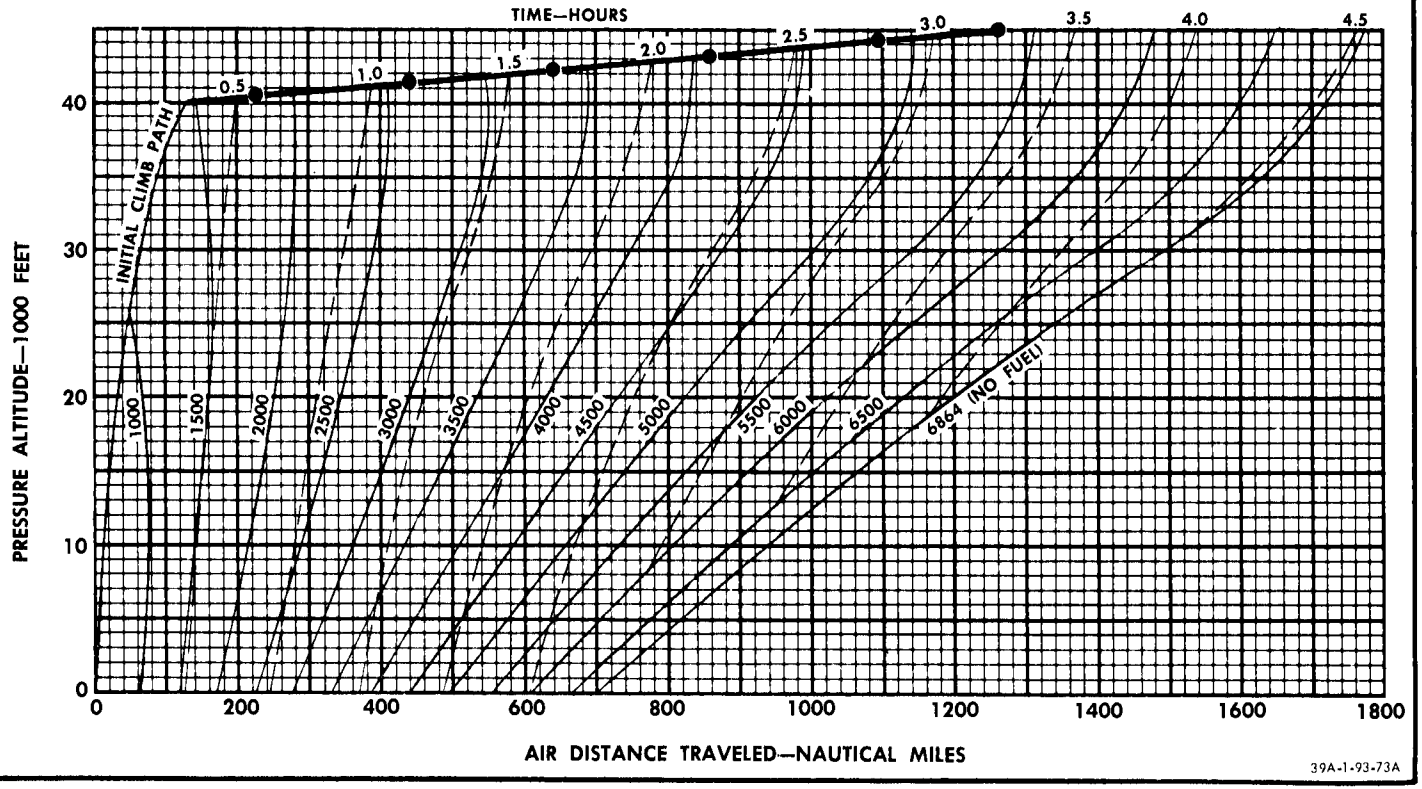


Figure A4-1

DATA AS OF: OCTOBER 1964
BASED ON: **FLIGHT TEST**
(USAF FTC-TDR-64-23, AND NAA)

OPERATIONAL RANGE PROFILE

MAXIMUM GROSS WEIGHT-18,650 LB
(AIRPLANES CHANGED BY T.O. 1T-39A-549)

MODEL: T39A
ENGINES: (2) J60-P3 OR -3A
FUEL: JP-4

NOTE

1. Fuel allowance of 380 pounds for start, taxi, take-off, and acceleration to climb speed schedule included.
2. Use Military Thrust for climb.
3. Cruise-climb at Normal Rated Thrust and .76 Mach number.
4. Cruise at recommended Mach number.

CRUISE-CLIMB PATH
POUNDS OF FUEL USED
TOTAL ELAPSED TIME

CRUISE DATA				
ALTITUDE	MACH	CAS	TAS	FUEL FLOW LB/HR
CRUISE-CLIMB	.76		436	1630-1270
30,000	.64	240	380	1670-1460
20,000	.55	250	335	1870-1700
10,000	.49	270	315	2250-2100
SEA LEVEL	.45	300	300	2880-2750

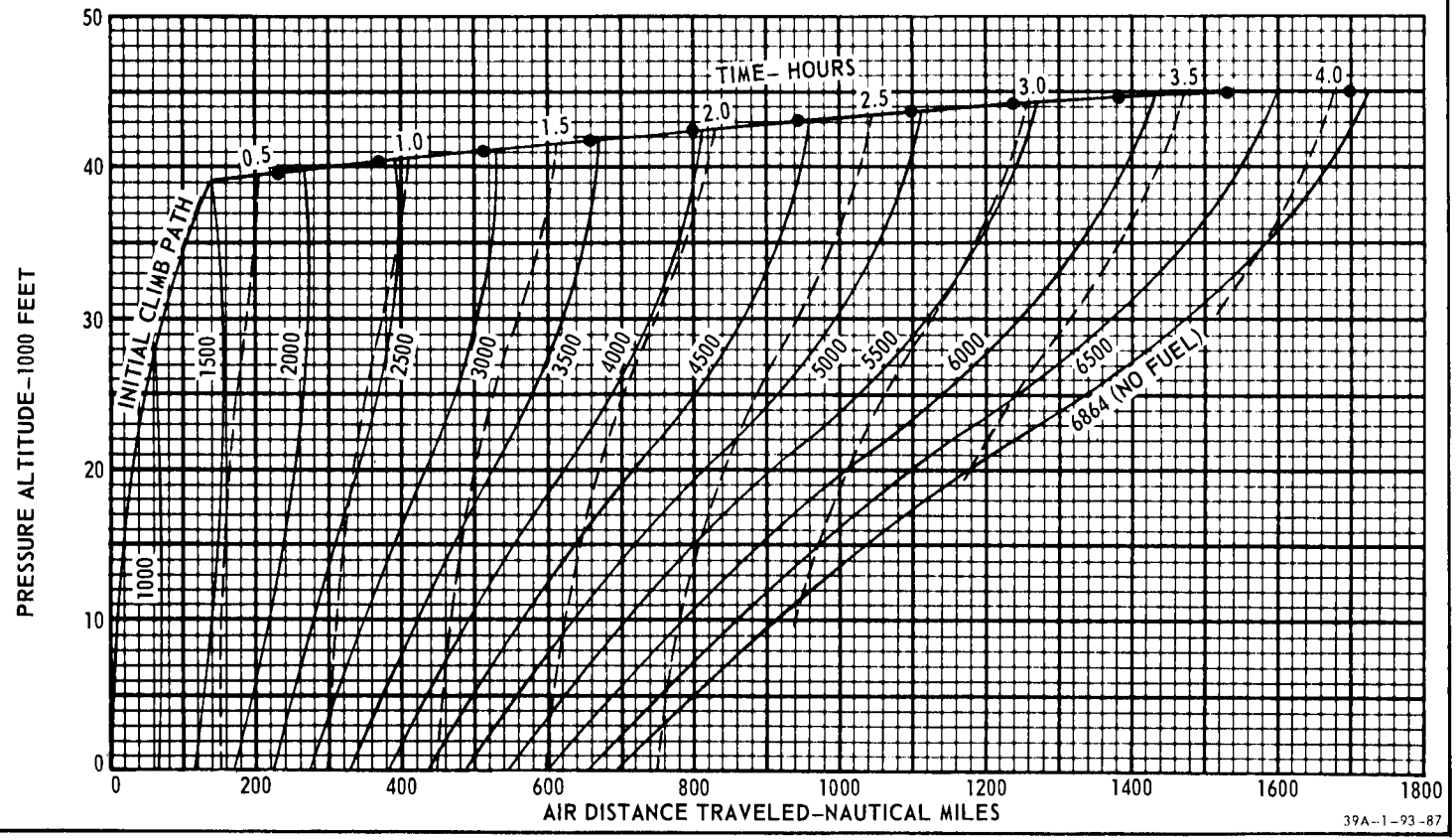


Figure A4-1A

DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-64-23 AND NAA)

MAXIMUM RANGE PROFILE

MAXIMUM GROSS WEIGHT—17,760 LB
(AIRPLANES NOT CHANGED BY T.O. 1T-39A-549) NEW

MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4

NOTE

1. Fuel allowance of 380 pounds for start, taxi, take-off, and acceleration to climb speed schedule included.
2. Use Military Thrust for climb.
3. Cruise-climb at Normal Rated Thrust and .72 Mach number.
4. Cruise at recommended Mach number.

CRUISE-CLIMB PATH
POUNDS OF FUEL USED
TOTAL ELAPSED TIME

CRUISE DATA				
ALTITUDE	MACH	CAS	TAS	FUEL FLOW LB/HR
CRUISE-CLIMB	.72		412	1500-1100
40,000	.67	190	384	1460-1130
30,000	.57	205	335	1530-1200
20,000	.48	218	295	1660-1350
10,000	.42	230	268	1930-1610
SEA LEVEL	.36	240	240	2280-2060

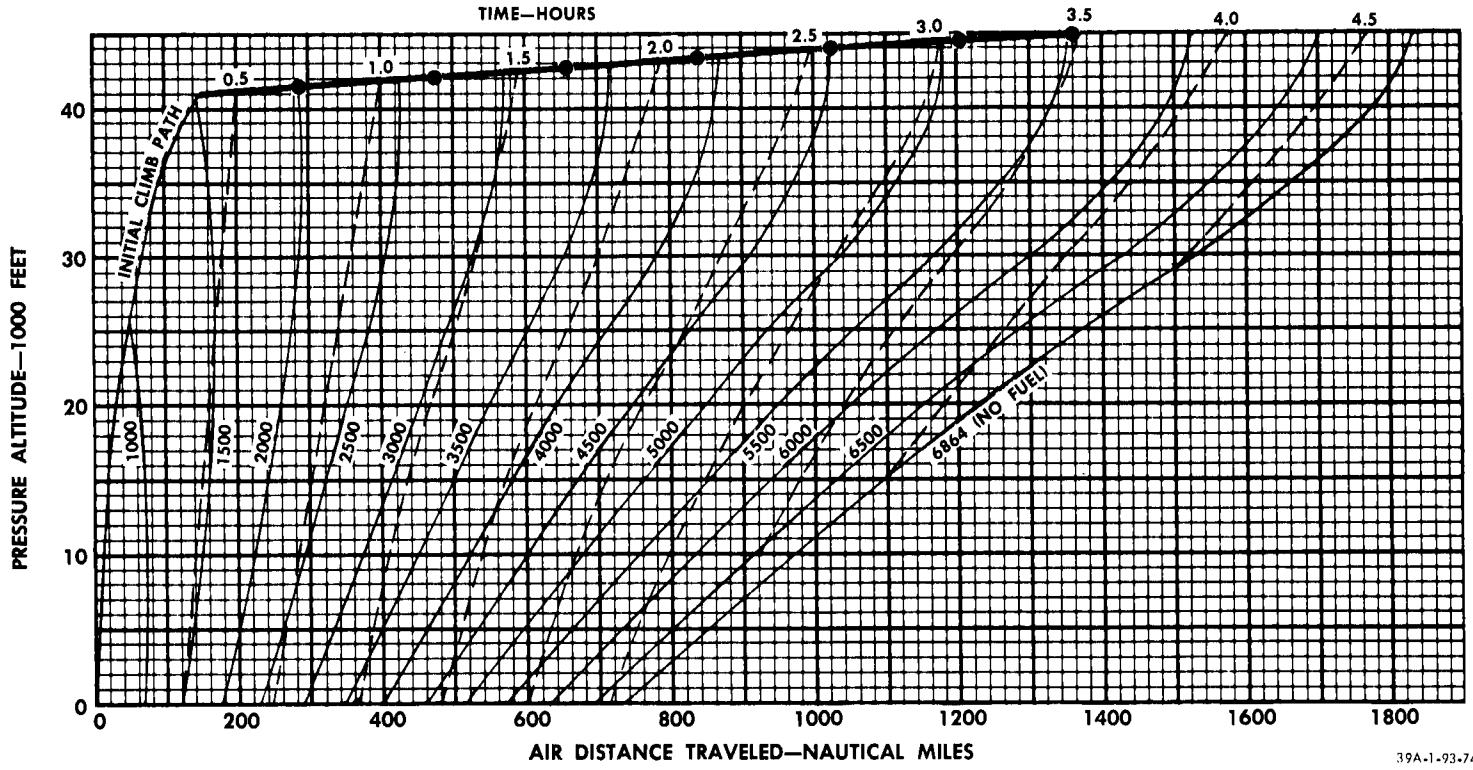


Figure A4-2

DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST
(USAF FTC-TDR-24-23, AND NAA)

MAXIMUM RANGE PROFILE

MAXIMUM GROSS WEIGHT-18,650 LB
(AIRPLANES CHANGED BY T.O. 1T-39A-549)

MODEL: T-39A
ENGINES: (2) J60-P-3 OR -3A
FUEL: JP-4

NOTE

1. Fuel allowance of 380 pounds for start, taxi, take-off, and acceleration to climb speed schedule included.
2. Use Military Thrust for climb.
3. Cruise-climb at Normal Rated Thrust and .72 Mach number.
4. Cruise at recommended Mach number.

CRUISE CLIMB PATH
POUNDS OF FUEL USED
TOTAL ELAPSED TIME

CRUISE DATA				
ALTITUDE	MACH	CAS	TAS	FUEL FLOW LB/HR
CRUISE CLIMB	.72		412	1570-1120
40,000	.67	190	384	1540-1140
30,000	.57	205	335	1600-1210
20,000	.48	218	295	1770-1370
10,000	.42	230	268	2010-1580
SEA LEVEL	.36	240	240	2400-2010

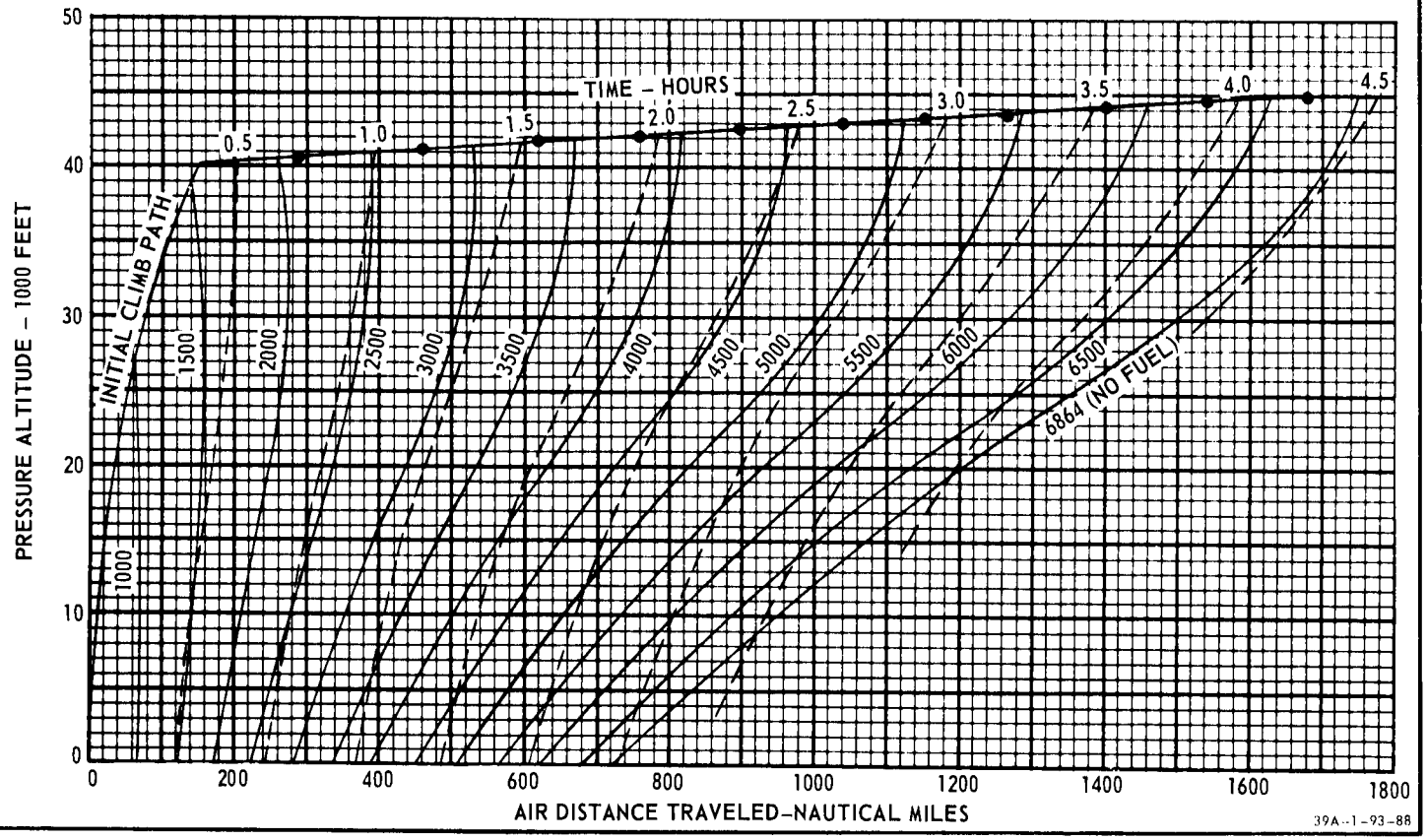


Figure A4-2A

DATA AS OF: OCTOBER 1964
BASED ON: **FLIGHT TEST**
(USAF FTC-TDR-64-23, AND NAA)

SINGLE-ENGINE RETURN PROFILE

MAXIMUM GROSS WEIGHT — 17,760 LB
(AIRPLANES NOT CHANGED BY T.O. 1T-39A-549) NEW

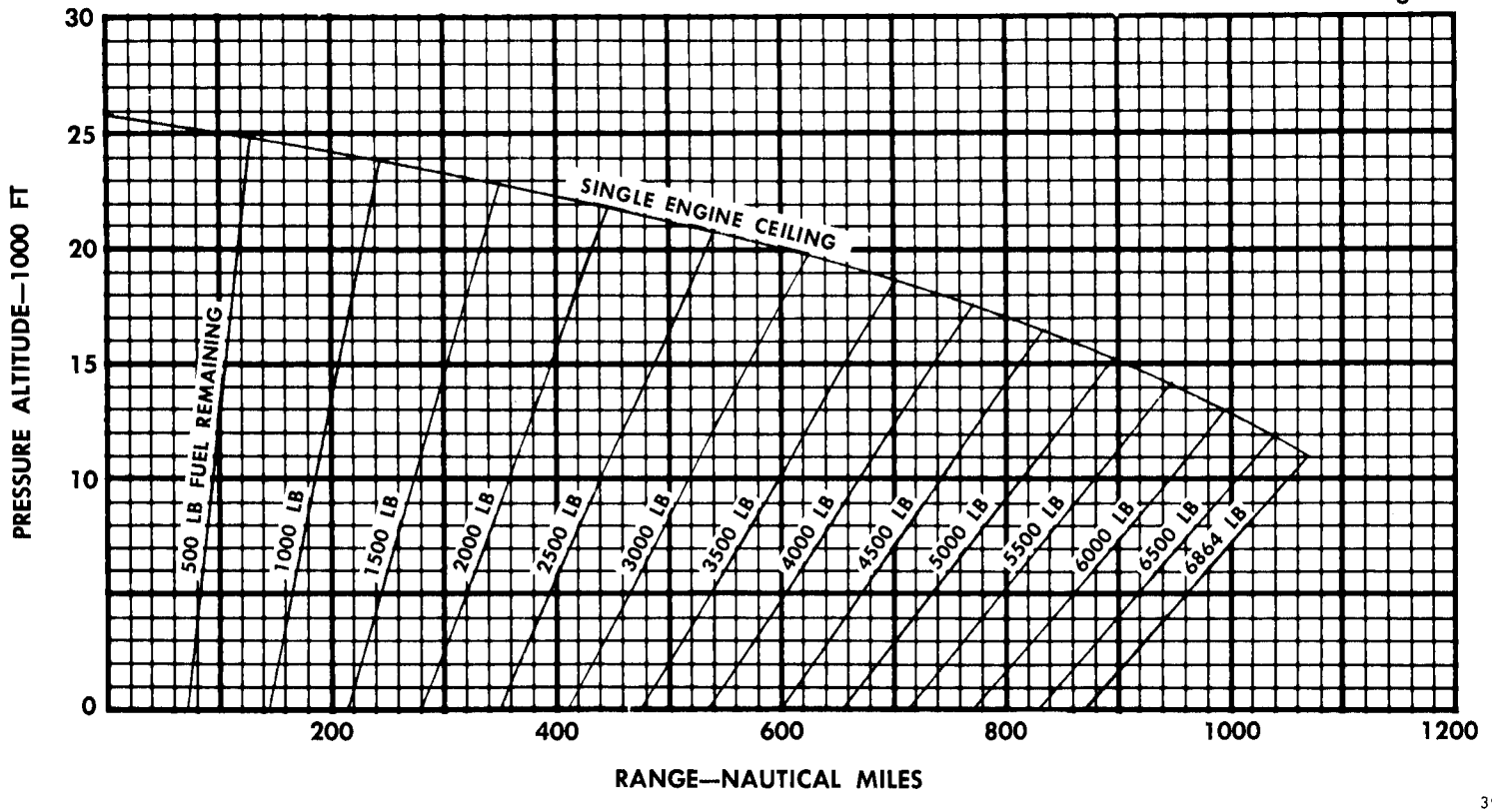
MODEL: T-39A & B
ENGINES: (2) J60-P-3 or -3A
FUEL: JP-4

NOTE

- Data does not include any reserve fuel.
- Single-engine ceiling is based on Normal Rated Thrust.

PRESSURE ALT—FT	MACH NO.	APPROXIMATE CAS	APPROXIMATE TAS*	APPROXIMATE FUEL FLOW LB/HR
CRUISE CLIMB			266	1710 TO 990
20,000	.414	191	254	1250 TO 1050
10,000	.368	203	235	1530 TO 1220
SEA LEVEL	.322	213	213	1690 TO 1430

* Average



39A-1-93-75A

Figure A4-3

DATA AS OF: OCTOBER 1964
BASED ON: FLIGHT TEST (USAF FTC-TDR-64-23, AND NAA)

SINGLE ENGINE RETURN PROFILE

MAXIMUM GROSS WEIGHT – 18,650 LB
(AIRPLANES CHANGED BY T.O. 1T-39A-549)

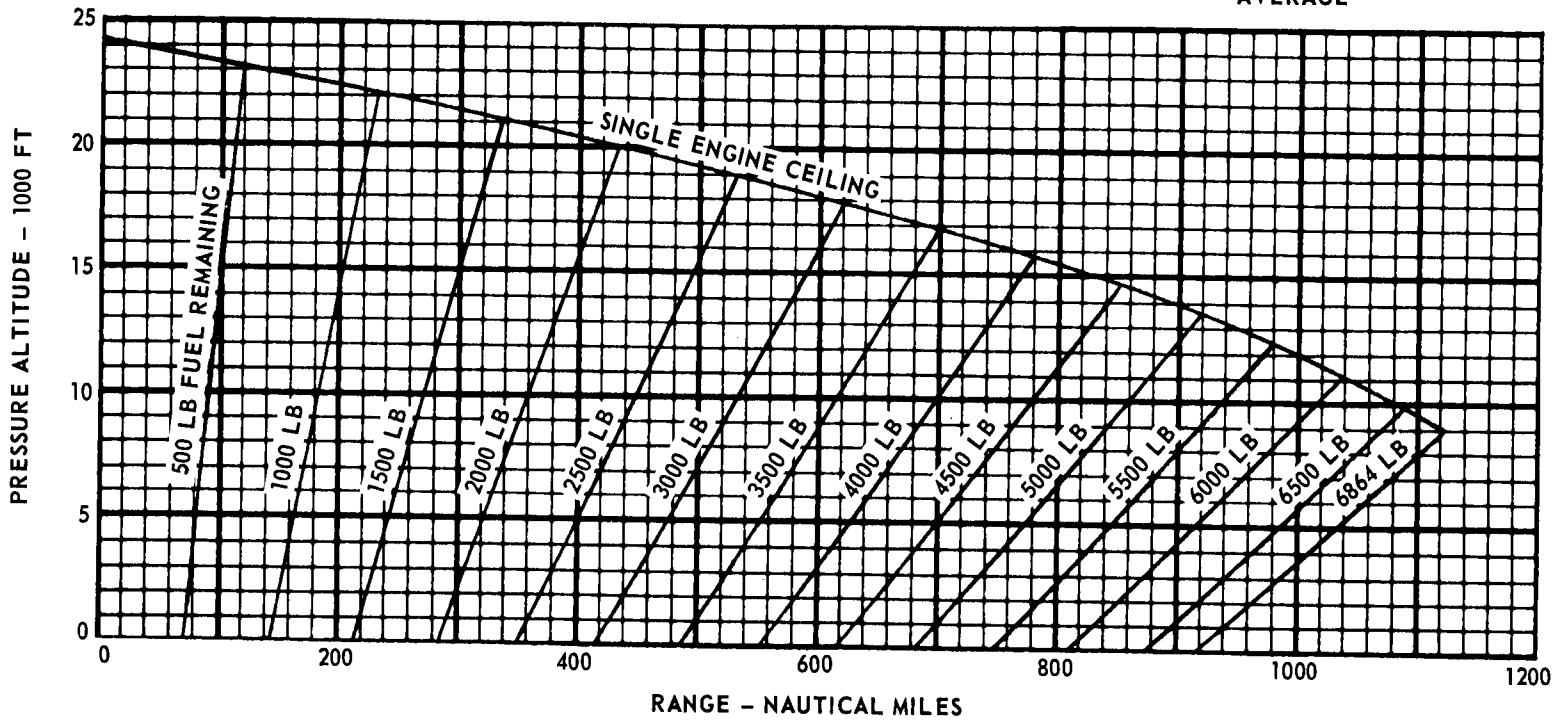
MODEL: T-39A
ENGINE: J60-P-3 OR -3A
FUEL: JP-4

NOTE

- Data does not include any reserve fuel.
- Single-engine ceiling is based on Normal Rated Thrust.

PRESSURE ALTITUDE FEET	MACH NO	APPROXIMATE		
		CAS	TAS*	FUEL FLOW LB/HR
CRUISE CLIMB			269	1820–1080
15,000	.426	211	263	1530–1130
10,000	.391	217	248	1730–1200
5,000	.363	220	236	1850–1250
SEA LEVEL	.349	229	229	1950–1390

*AVERAGE



39A-1-93-89

Figure A4-3A

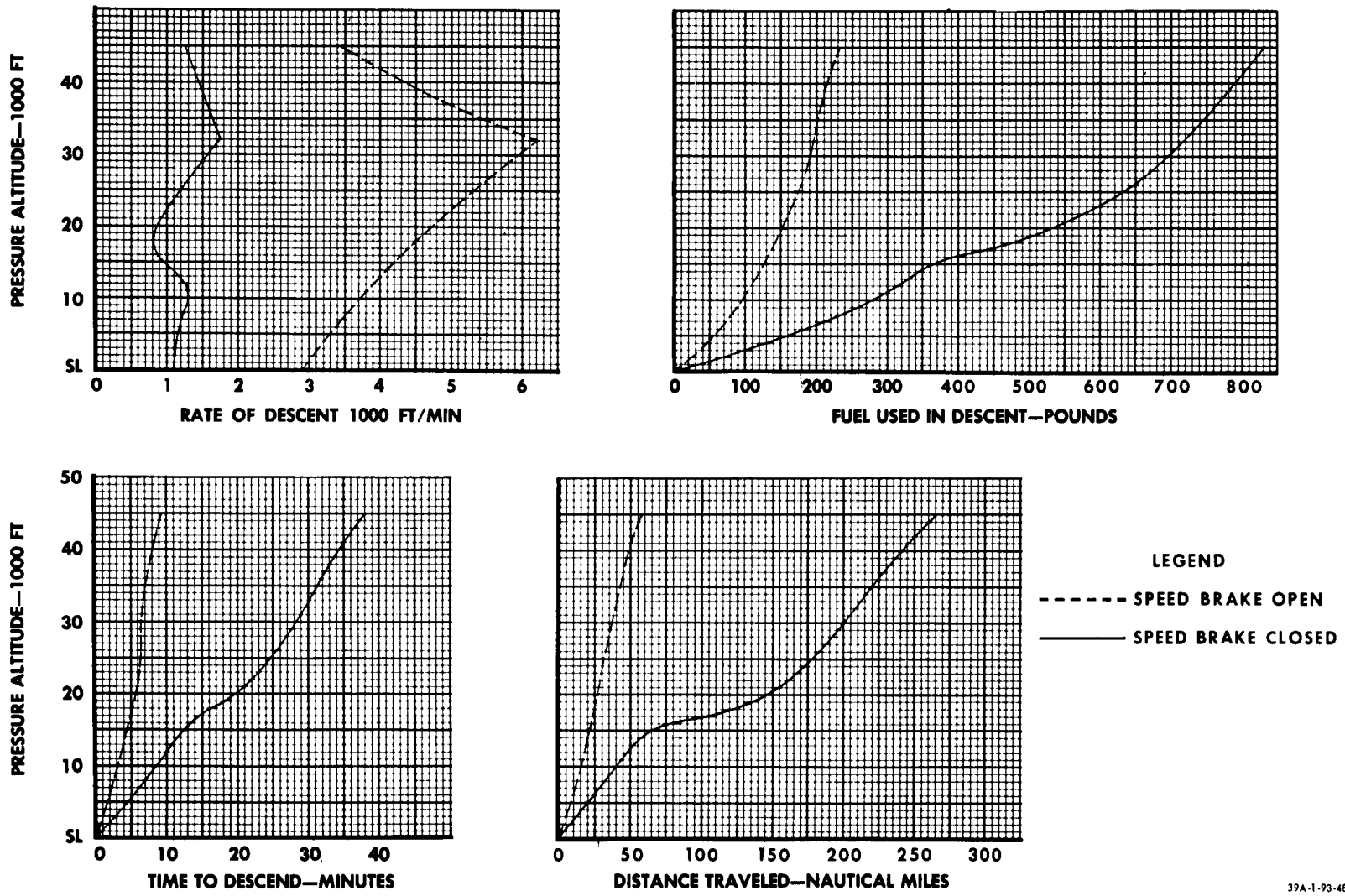
DATA AS OF: 20 JUNE 1962
BASED ON: NAA FLIGHT TEST
AND ESTIMATED FUEL FLOWS

PENETRATION DESCENTS

MODEL: T-39A & B
ENGINES: (2) J-60-P-3 or -3A
FUEL: JP-4

NOTE

- Use 75% rpm, speed brake open or closed. Descend at .7 Mach or 250 knots IAS, whichever is less.
- For speed-brake-closed descent below 15,000 feet, use 65% rpm.



39A-1-93-48D

Figure A5-2